

KENTUCKY RIVER DEVELOPMENT: THE COMMONWEALTH'S WATERWAY

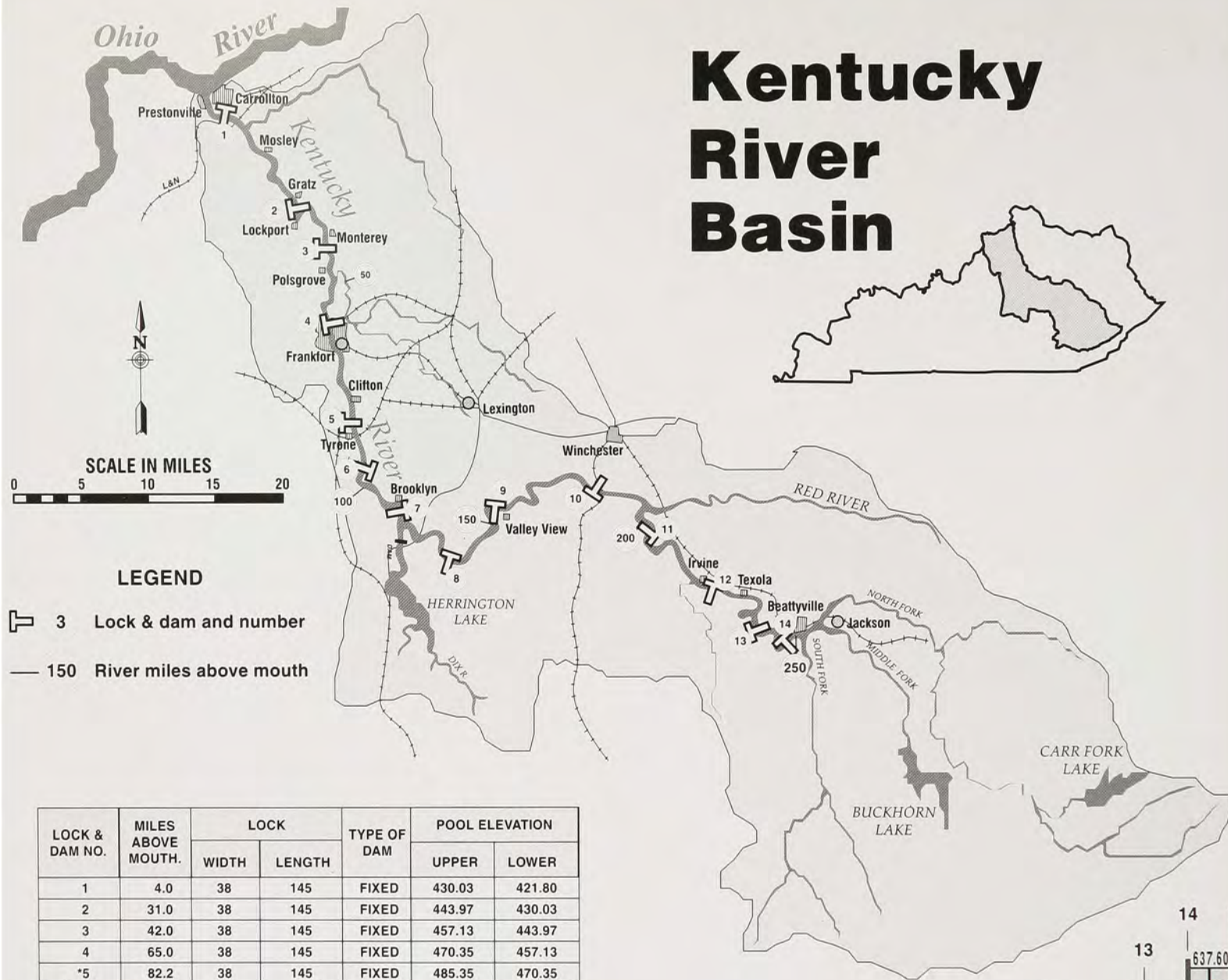
Leland R. Johnson
and
Charles E. Parrish



U.S. Army Corps of Engineers, Louisville District

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1999		2. REPORT TYPE		3. DATES COVERED 00-00-1999 to 00-00-1999	
4. TITLE AND SUBTITLE Engineering the Kentucky River: The Commonwealth's Waterway				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Corps of Engineers,Louisville District,PO Box 59,Louisville,KY,40201				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 246	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Kentucky River Basin

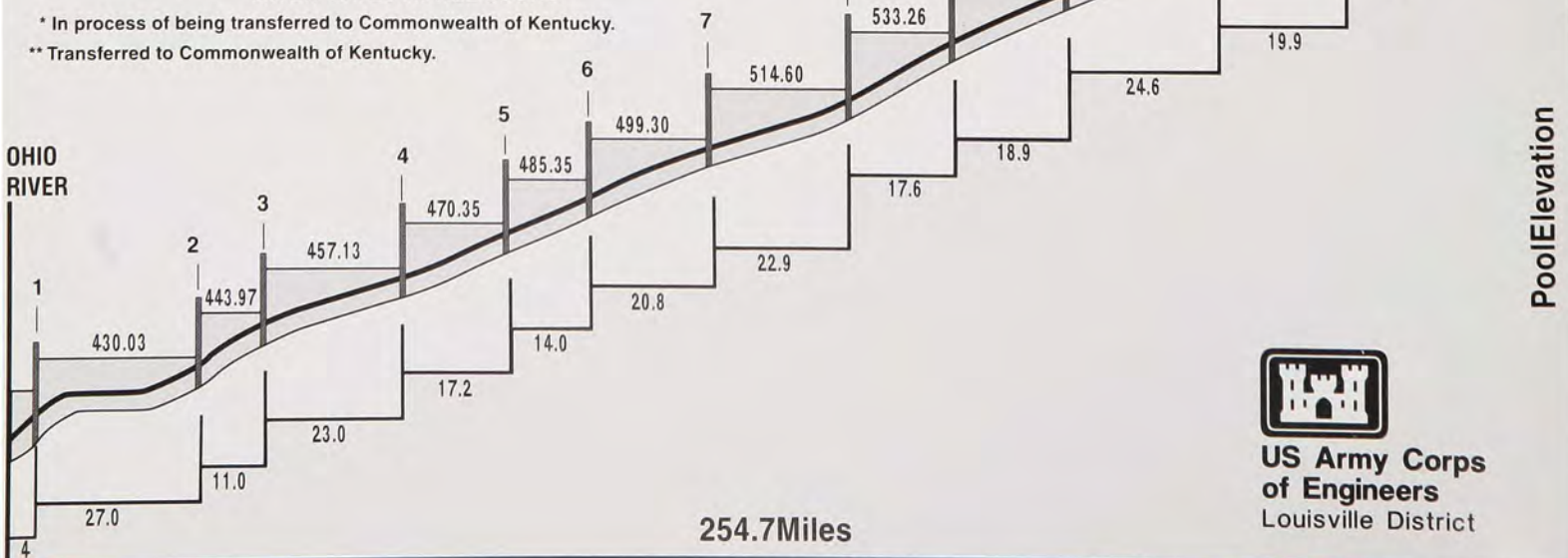


LOCK & DAM NO.	MILES ABOVE MOUTH.	LOCK		TYPE OF DAM	POOL ELEVATION	
		WIDTH	LENGTH		UPPER	LOWER
1	4.0	38	145	FIXED	430.03	421.80
2	31.0	38	145	FIXED	443.97	430.03
3	42.0	38	145	FIXED	457.13	443.97
4	65.0	38	145	FIXED	470.35	457.13
*5	82.2	38	145	FIXED	485.35	470.35
*6	96.2	52	147	FIXED	499.30	485.35
*7	117.0	52	147	FIXED	514.60	499.30
*8	139.9	52	146	FIXED	533.26	514.60
*9	157.5	52	148	FIXED	550.60	533.26
**10	176.4	52	148	FIXED	567.60	550.60
*11	201.0	52	148	FIXED	585.60	567.60
*12	220.9	52	148	FIXED	602.60	585.60
*13	239.9	52	148	FIXED	620.60	602.60
*14	249.0	52	148	FIXED	637.60	620.60

MITER GATES AT ALL LOCKS

* In process of being transferred to Commonwealth of Kentucky.

** Transferred to Commonwealth of Kentucky.



US Army Corps of Engineers
Louisville District

**ENGINEERING THE KENTUCKY RIVER:
THE COMMONWEALTH'S WATERWAY**

Leland R. Johnson and Charles E. Parrish
1999

All illustrations unless otherwise noted are from collections of the Louisville Engineer District, U.S. Army Corps of Engineers.

Library of Congress Cataloging

Johnson, Leland R.

Engineering the Kentucky River: The Commonwealth's Waterway / Leland R. Johnson and Charles E. Parrish.

p. cm.

Includes bibliographical references and index.

1. River engineering -- Kentucky -- Kentucky River -- History. 2 Inland navigations -- Kentucky -- Kentucky River -- History. I. Parrish, Charles E., 1942- II. Title.

TC425.K43 J65 1999

627'.12'097693--dc21

Book design/layout by Debi Schoenbaechler, Louisville Engineer District.
Print production supervised by David Duggins, Louisville Engineer District.

This book is set in Palatino typeface, printed on white 70# Sappi Lustro Dull Text stock, with cover of laminated white 120# Sappi Lustro Gloss Cover stock.

This publication is available from Louisville District, P.O. Box 59, Louisville, KY, 40201-0059.
Additional information about the activities of the Louisville District available on the internet at <http://www.lrl.usace.army.mil>

Printed in the United States of America

Foreword

The Kentucky River laces through the Commonwealth's history like a varicolored thread. For untold centuries this river scoured, cut, and opened a channel through seemingly impenetrable barriers of stone to drain a third of the State of Kentucky. Over the centuries there gathered along its banks a galaxy of human occupants, ranging from those Paleolithic wanderers who left abundant artifactual evidence of their passage to the arrival of Euro-American peoples. The Kentucky profoundly influenced all of them as, paradoxically, a gathering and a divisive range line in every stage of human history.

The cardinal, indeed the central, chapter in its history was the struggle to open the river as a transportation outlet for shipping products of the fertile land it drains. Leland R. Johnson and Charles E. Parrish have diligently and thoroughly ferreted out details of the various efforts to make it serve transportation needs. They present graphic accounts of commerce on the river, even listing cargo manifests of boats plying the stream and tracing the steamboat and towboat tonnages of Kentucky products traveling it for sale at domestic and foreign markets.

The authors have resurrected from the morgue of Kentucky documentary sources the pertinent records of Kentucky's convoluted campaign to build internal improvements—macadam roads, railroads, and slackwatered rivers. They relate gubernatorial, legislative, and business interests in these pioneer transportation projects, focusing on the efforts to build locks and dams on the Kentucky River.

The movement to create slackwater pools for navigation on the Kentucky River challenged boatmen, engineers, and public officials at every step. Locking the Kentucky behind fourteen dams and locks required prodigious engineering skills and daring, heavy capital investments, and a generous share of luck. The story the authors relate of engineering on the Kentucky is, in microcosm, the story of waterways engineering throughout the United States, even on the great Mississippi River itself.

Their account of the place of the Kentucky River in the history of the Commonwealth adds distinctive new perspectives on how pioneers met the baffling problems of opening efficient transportation channels. An explicitly written and solid piece of research, no clearer explication of how this willful stream has influenced the history of the state and nation has been written. It's a tremendously interesting and insightful addition to the history of Kentucky's transportation network, especially the locking and damming of its central river. It would have been wonderful if this study had been available to me back in 1939 when I wrote my history of the stream.

One thing is certain. The Kentucky River ripples on in menacing flood tides and strangulating droughts, virtually defying human efforts to bridle it and make it responsive to human will. This study becomes an important source for understanding not only the challenges met on the river in the past, but also those that Kentuckians face now and will encounter in the future

Thomas D. Clark

PREFACE

Rising on the western slope of the Appalachians, slashing through towering palisades across central Kentucky and emerging from the hills at Frankfort, the Commonwealth's capital, the Kentucky River flows 256 miles from its Three Forks sources to enter the Ohio River midway between Cincinnati and Louisville. Among all Ohio River tributaries, it stands foremost in scenic beauty. Indeed, the Commonwealth's ecotourism boosters have compared the Kentucky's environmental charms to Arizona's spectacular Grand Canyon or Europe's magnificent Rhine River. Like the Grand Canyon and the Rhine, the Kentucky River has also been developed through engineering to serve human needs, and this is the story of its engineering development.

Native American Indians navigated the Kentucky River in prehistoric times, and during centuries since explorer Thomas Walker canoed it in 1750 the Kentucky has floated every conceivable type of watercraft up and down its turbulent waters. Providing access from the Ohio River to the central Bluegrass and rich Appalachian resources, the river transported Euro-American explorers and settlers into the region, then took their frontier produce and manufactures to markets aboard unpowered flatboats, keelboats, and sailing ships. Pioneer marine engineering facilitated use of the Kentucky for transportation and stimulated interest in changing the river's natural regimen to better serve the Commonwealth's need for access to markets.

The design engineering of steamboats during the early nineteenth century inspired dreams of developing the Kentucky River as a link to prosperous Ohio and Mississippi River commerce, and in 1836 the Commonwealth began building locks and dams on the Kentucky to provide reliable year-round navigation from its mouth to its sources at the Three Forks. By transporting the Bluegrass's agricultural produce and the mineral and forest resources of the Appalachians, the Commonwealth expected its river improvement project to foster the state's commercial prosperity. When these dreams collapsed in 1842, only five of the state's locks and dams planned on the Kentucky were completed and less than half the river's length had slackwater navigation available. By collecting tolls from passing boats, however, the Commonwealth funded the operation of its locks and dams until the dams collapsed and failed in 1876.

Visions of the commercial prosperity that might develop if more locks and dams were constructed on the river gripped the imagination of Kentuckians, and in 1880 they persuaded Congress to pursue their vision. At the direction of Congress, the U.S. Army Corps of Engineers restored the slackwater navigation on the lower Kentucky by 1883, then built additional locks and dams to extend the slackwater farther upstream. During thirty years of hard labor, the Corps built nine more locks and dams, increasing the total number to fourteen and at last reaching the river's sources, the Three Forks, in 1917. This developed the river's entire course, transforming it from a wild, unfettered stream into a fully engineered waterway, ready to serve steamboat commerce throughout the years.

Concurrently with completion of the Kentucky River development in 1917, the steamboat commerce it was designed to support came to an abrupt end. As a result, the locks and dams development was derisively labeled a white elephant, the "famous porkbarrel." During the following half century, brave efforts to make the river serve emerging towboat and barge commerce proceeded with but meager success. At the same time, engineering development of the river continued for purposes in addition to navigation. Its hydroelectric power potential was developed in part, projects were completed to reduce damages

from its floods, and its uses for recreation and water supply became important. By the waning years of the twentieth century, however, the Commonwealth and the Corps of Engineers confronted wrenching economic and environmental decisions on the future of the Kentucky's obsolete yet historic slackwater navigation development. This required unique planning and innovative management that may set the parameters for Kentucky River development during the twenty-first century.

This Kentucky River development history focuses on the projects engineered by the Commonwealth of Kentucky and the Corps of Engineers to foster river navigation. Although frustrated in the end by other evolving transportation modes, the Kentucky River's locks and dams project was a pioneering effort at water resource development, an engineering marvel of its time. Monumental studies of the Kentucky River by Mary Verhoeff, Thomas D. Clark, and J. Winston Coleman distinctly outlined the project's history, together with its social and commercial effects in the valley, but this is the first study to provide a detailed review of its rationale, engineering, construction, and operation. Understanding the Kentucky River development is fundamental to comprehending the historical development of the Commonwealth itself, because this "dark and bloody" river, this artery of civilization, after all, lent its name to the Commonwealth and to we who proudly call ourselves Kentuckians.

From the national perspective, the history of the Kentucky River development casts light on the early efforts by the U.S. Army Corps of Engineers to develop slackwater navigation for steamboat commerce on tributaries of the Ohio River such as the Kentucky. It outlines the Corps' application of nineteenth century technology to lock and dam construction, its shift to concrete and steel technology during the twentieth century, and its efforts to make the Kentucky serve regional transportation needs. The end of steamboat commerce, supplanted by towboat and barge traffic, made the Kentucky River navigation project obsolete, and, in cooperation with state and local agencies, the Corps participated in development of the river for flood control, hydroelectric power, water supply, and improved environmental quality. This transition on the Kentucky River reflects similar policy shifts on other Ohio River tributaries and throughout the nation.

Scores of Kentuckians assisted with the authors' research, pointing us to the sources and providing access to archives and libraries throughout the Commonwealth. Boat captains, lockmasters, historians, and other Kentucky River folk made time in their busy schedules to contribute mightily to the authors' education, and the authors are indebted to these friends and gratefully list a few of them in our acknowledgments.

Leland R. Johnson

Charles E. Parrish

ACKNOWLEDGMENTS

Too many Kentuckians, archivists, librarians, and historians assisted this study's research to list here. The authors would be remiss, however, if they did not express heartfelt gratitude to Henry Gwiazda II and Jennifer Nelson of the National Archives Cartographic Branch and William Lind and Michael Musick of National Archives Military Reference staff. Mary Ann Hawkins at the National Archives Southeast Region and Beverly Watkins and Glen Longacre of the National Archives Great Lakes Region also granted access to vital sources.

Within the Commonwealth, the authors appreciate the kind assistance of Riley Handy, Connie Mills, and Nancy D. Baird of the Kentucky Library at Western Kentucky University, Bowling Green; of Ron Bryant at the Kentucky Historical Society Library; and Bill Richardson and Tom Tingle at the Kentucky State Library and Archives in Frankfort. Bill Marshall at the Margaret I. King Library Special Collections in Lexington, William Ellis and Charles Hay of Eastern Kentucky University, Richmond, Bill Carner of the University of Louisville, and Thomas D. Clark, historian emeritus of Kentucky provided specialized support, as did the library staffs at Centre College, Danville, and Transylvania University, Lexington.

For help with graphics, the authors are indebted to Charles Siddaway, Gerald Sutphin, Jack and Sandy Custer, Leonard Falcone, Maurice Flynn, Timothy Gaines, Louis Webb, James C. Thomas, Ron Russell, Jerry Raisor of Fort Boonesborough, Susan Hobbs of the Beattyville Enterprise, Charles Hayes of the Kentucky Explorer, Larry Meadows of Clay City, and the family of Lockmaster John A. Walters. We also acknowledge the expert assistance of David Duggins and Deborah Schoenbaechler in the Louisville District Information Management Office for their care in preparing the manuscript for publication.

The authors' understanding of Kentucky River navigation was greatly enhanced by contributions from Bill Yount of Frankfort, Mary Jean Kinsman of The Filson Club, Bill Grier and Hugh Archer of the Kentucky River Authority, Thomas Benton of Louisville, Ralph McClanahan of Ravenna, Bob Gates of the Kentucky Folklife Program, Captain C. W. Stoll of Louisville, and Veronica Rife, Kentucky River Project Manager for the Corps of Engineers, Louisville District.

William C. Baldwin and Martin Reuss of the Office of History, Corps of Engineers, Headquarters, Washington, provided perceptive critical reviews of the first draft, making suggestions that were incorporated into this publication.

We are especially indebted to Captain Lowell Smith who provided the *Salcomb II* for a memorable weekend houseboat cruise through the lower four locks on the Kentucky River, an experience which will be long remembered.

Finally, the authors owe thanks to their families who gracefully suffered the authors' preoccupation with the Kentucky River for many years.

Leland R. Johnson

Charles E. Parrish

TABLE OF CONTENTS

Foreword	i
Preface	iii
Acknowledgments	v

Chapter

1. The Pioneer Navigation	1-14
2. Internal Improvements	15-28
3. The Scientific Man	29-42
4. A Valentine to the Legislature	43-54
5. The Eleventh Hour	55-68
6. Slack Water and Dams	69-80
7. Struggles on the Kentucky	81-90
8. The Disastrous Debut	91-104
9. The Timbercrib Project	105-118
10. The Concrete Results	119-130
11. The Famous Porkbarrel	131-142
12. The Rhine of Kentucky?	143-156
13. Kentucky River Transition	157-168
NOTES	169-202
BIBLIOGRAPHY	203-214
INDEX	215

1

THE PIONEER NAVIGATION

The Kentucke River rises with three heads from a mountainous part of the Country. Its northern branch interlocks with the Cumberland: runs half way in a western direction, and the other half N. westerly. It is amazingly crooked, upwards of two hundred miles in length, and about one hundred and fifty yards broad.

John Filson, 1784

Travelers zipping along interstate highways across the Commonwealth may cross two or more high bridges spanning a spectacular river gorge. If they look down, they see an astounding abyss and a winding ribbon of river sparkling beneath them. While steering vehicles or contemplating their fast-paced lives, most don't look down. They pass without notice the Commonwealth's artery of civilization.

Twentieth-century transportation bypasses the Kentucky River, a bold stream that is, as pioneer John Filson remarked, amazingly crooked. Among American rivers, it is boldly unique, draining 7,000 square miles of the Commonwealth and watering the state capital at Frankfort. Three headwater tributaries called North, Middle, and South Forks tumble from sources on the coal-rich western slope of the Appalachians to a juncture where they form the Kentucky. From this confluence, the river spirals westerly through the hills toward Boonesborough and there enters a steeply palisaded entrenched gorge, cutting through the gently rolling Bluegrass region and arcing north to Frankfort. After snaking lazily through the state capital, it rushes down to the Ohio River at Carrollton where its 255-mile trip across the state ends. Encompassing most of thirty-three Kentucky counties, the river supplies water to about twenty percent of the Commonwealth's people.

While travelers cross the high bridges without thought, geologists pause to contemplate this "Grand Canyon of the East." They know this sparkling stream cuts through Kentucky's oldest surface rock, the Ordovician limestone of the Bluegrass tableland. Pushed up and bowed by geologic pressures, this limestone forms an arch of stone on a line from Cincinnati, Ohio, to Nashville, Tennessee. As this arch pushed upward, the Kentucky River ate its way through the rock, incising itself three hundred feet below the surface and eroding its distinctive gorge and palisades. The oldest fossils in Kentucky are found in the rock of the Bluegrass, and they are marine invertebrates, marking their formation in primordial shallow seas with muddy bottoms. The belt of isolated conical hills called the Knobs ringing the Bluegrass are younger rocks, containing the first vertebrate fossils found in the state; and in its mountainous Appalachian headwaters, the Kentucky flows from younger Mississippian and Pennsylvanian rocks rich in coal and fossils formed in swamps geologic eons ago. Traces of the powerful pressures thrusting these rock formations to the surface are seen in the geologic faults lining the river. Geologists and paleontologists, amateur and professional alike, find these features fascinating, well worth a stop for closer examination.

The Kentucky's geologic topography makes its hydrology truly unusual among rivers. The Three Forks at their sources descend from mountains up to 3,200 feet above sea level through deeply dissected valleys. Running quickly off rocky soils, rain and snowmelt rush down steep valleys to the juncture of the

Forks at Beattyville, Kentucky, where the elevation is 620 feet. From the Three Forks, the Kentucky descends another 220 feet to its confluence with the Ohio River midway between Cincinnati and Louisville. Precipitation soon fills the narrow valley of the Kentucky and its tributaries, sending sudden floods down the streams with devastating consequences for all in their path. Called "tides" in the mountains, these sudden rises and flash floods have carried off the property and lives of many Kentuckians, including one of the Commonwealth's Governors.

Since the pioneer days, Kentucky River floods have been notorious. A traveling minister visiting the river's gorge and palisades in 1795 found its waters at flood tide and detected evidence of higher floods. "From the bed of the river to the highest point of the cliff the rock seems to have an appearance like that of a river bank, where a number of marks appear, pointing out to the beholder how high the water has been in a fresh [flood]," the clergyman exclaimed, adding his reverent speculation: "This appearance suggests an idea and confirms the history of a universal flood, the powerful effects of which, operating upon the limestone rock, which being of a dissoluble nature, have made these variations."¹

As this pioneer minister observed, the geologic history of Kentucky River floods is marked by incised meander loops impinging at the bases of the high cliffs. The low and intermediate level abandoned meander loops attest also to the river's origin as a tributary to the pre-glacial Teays River. During the last geologic ice age, glaciers advancing south dammed the Teays River near Cincinnati, spilling its drainage over a divide near Madison, Indiana, to create the Ohio River. Older than the Ohio River, the Kentucky is the most extensive entrenched, meandering waterway in the eastern United States, virtually a "grand canyon."

After its floods recede, the Kentucky River's flow diminishes as rapidly as it rises, and during prolonged droughts its flow dwindles to a puny trickle and its tributaries go dry. The same pioneer cleric who saw the Kentucky at flood also penned a vividly descriptive account of an extended drought in 1795:

Stock of all kinds have suffered very much. Horses, to my knowledge, have not drank a single drop of water for many days together, and cattle could only hold out their tongues, where they once drank the refreshing streams. The far greater part of the springs were stopped running, and few were not entirely dry. Bottoms of the mill ponds were as dry as a hearth, and numbers of people had to fetch [water] several miles. A day or two the whole face of the country was dry as tinder, and consider the rivers had ceased to flow in their channels.²

The characteristic sudden floods, swift runoff, and droughts in the Kentucky River basin posed difficulties for the pioneers who sought to use the stream as their commercial outlet. Embarking on floods made steering their frail craft around the river's narrow and crooked bends hazardous, but if they delayed their departure too long they stranded on sand and gravel bars or found their passage blocked by rocky falls at the ripples. Still, the oldest records and archaeological evidence attest that humans have traveled this artery of civilization for as long as they have lived in Kentucky. From canoes and flatboats at the earliest time, to sailing ships and steamboats in the nineteenth century, to twentieth-century diesel towboats, the Kentucky River has conducted all manner of watercraft to their destinations. This commercial navigation made it a cradle of American inland river navigation and improving its channel for more reliable navigation became a preoccupation of Kentuckians.



Native American Indian families and their canoes traveled the Kentucky River.

Prehistoric natives canoed the river, engaging in long-distance travel and trading long before Europeans arrived during the eighteenth century. The Shawnee of Kentucky traded with the Cherokee and even with early Spanish settlements in Florida.

Although wars among the tribes drove most of the Shawnee from Kentucky, when Europeans explored the region in the eighteenth century they found the Shawnee village *Eskippakithiki* on Upper Howard Creek, a Kentucky River tributary draining the Bluegrass. The Iroquois called this village *kenta aki*, meaning place of level land, for this site seems flat compared to the knobs and mountains to its south. Historians think this village's name was anglicized as *Kentucky*, although others imagine this name of the state and river had different meanings—commonly “dark and bloody ground.”³

The Shawnee and their ancestors established villages near the Kentucky and its tributaries where fish and mussels were abundant. Fertile bottomlands along these streams easily produced corn, beans, and squash, and the salt licks, or mineral springs, near the river attracted game. The streams provided water and easy access by canoe for trade with other villages and tribes. In addition, the Warrior's Path, the great trace followed by the natives for overland travel between the Great Lakes and the Gulf of Mexico, roughly paralleled the Kentucky River and crossed it at Station Camp Creek, the modern site of Irvine, Kentucky.⁴

For waterborne travel and trade, the prehistoric natives preferred canoes. In shape, these closely resembled twentieth-century metal and fiberglass canoes, but were fabricated of wood, either of the bark or trunks of trees. To make a bark canoe, the natives girdled a large elm or hickory tree at ground level and again fifteen to twenty feet up the tree. After slitting the bark vertically from ground level to the upper girdling, the bark could be pulled from the tree, a process more easily done in springtime when the tree sap was up. Cutting wedges off each end and sewing the ends together with sinews or bark strips created a pointed rake fore and aft; sticks installed amidships held the canoe's sides apart; and smearing the seams with venison fat made the vessel temporarily water-tight. Experienced craftsmen could assemble bark canoes quickly and steer them with whittled paddles just as quickly across and along rivers. Their light weight was advantageous when portaging around obstructions, but striking rocks or snags soon sank bark canoes and they rotted if not kept moist and covered from the sun.⁵

European explorers also found bark canoes conveniently useful, and the first recorded navigation on the Kentucky River by a European was in such a craft. Explorer Thomas Walker and his companions from Virginia, arriving on the Kentucky River at the mouth of Station Camp Creek on May 24, 1750, found its water at flood and too high to walk across—to ford. Seeing hickory and elm trees there stripped of their bark for canoes—probably by the natives—Walker’s party stripped another tree of its bark, fabricated a canoe, and ferried across the river to the modern site of Irvine. Although later explorers and pioneers also traveled the river in bark canoes, they favored the more durable dugout canoes hollowed from the trunks of trees.⁶

After felling a tree, usually a poplar, sycamore, or pine, and stripping it of branches and bark, the native Kentuckians hollowed or dug out the log to create a boat. A British soldier who watched Cherokees build dugouts in 1761 described them as thirty to forty feet long and about two feet wide with flat bottoms and sides: “The Indians hollow them now with the tools they get from the Europeans, but formerly did it by fire,” the soldier observed, adding: “They are capable of carrying fifteen or twenty men, are very light, and can by the Indians, so great is their skill in managing them, be forced up a very strong current, particularly the bark canoes, but these are seldom used but by the northern Indians.”⁷

Explorers and pioneers commonly used canoes to ferry across or to paddle along the Kentucky River and its tributaries. Frontiersman James McBride canoed down the Ohio River in 1754, stopping at the Kentucky River’s mouth—modern Carrollton—to leave his mark. By 1775, when James Harrod and his companions canoed ninety-seven miles up the Kentucky and landed to found Harrodsburg, throngs of pioneers searching for lands to settle were paddling the river in dozens of canoes. The foremost accounts of pioneer canoeing on the Kentucky are the journals kept by Nicholas Cresswell and James Nourse, who paddled two dugout canoes up the Kentucky to Boonesborough in 1775. Their journals describe dugout canoes and also reveal the natural conditions and navigation hazards along the Kentucky River.⁸

Nicholas Cresswell, an English adventurer, and James Nourse, a Virginian searching for land in Kentucky, purchased two dugout canoes in Pennsylvania, dubbing them the *Charming Polly* and the *Charming Sally*. Both were thirty feet long and twenty inches wide, made from walnut logs, and Cresswell described them as hollowed out “like a manger,” resembling hollowed logs used on the frontier to hold cattle feed. Cresswell, Nourse, and six companions bound for Kentucky loaded their supplies in the dugouts, and boarded four paddlers in each dugout to guide their craft through dangerous rapids as they navigated the rugged Youghiogheny and Monongahela rivers to the wider Ohio River at Fort Pitt. At this future site of Pittsburgh they lashed their two canoes together as a unit to descend the Ohio, raising a mast and rigging a sail on the canoes to speed their passage. Captain George Rogers Clark in his own canoe joined them at the modern site of Wheeling, West Virginia, and floated with them down the Ohio to the Kentucky River’s mouth. When they entered the Kentucky on May 21, 1775, Nicholas Cresswell noted that this river, only 130 yards wide at its mouth, was much narrower than the Ohio.⁹

After paddling their dugouts a few miles up the Kentucky, these adventurers encountered the first of a series of rapids, or ripples, where river fall steepened and strong currents prevented them from ascending with paddles alone. They lashed ropes to their canoes and walked along the riverbank, towing their canoes upstream across the ripples. At one ripple, buffalo fording the river blocked their passage, and they slaughtered several of the shaggy beasts for meat. While moored to the riverbank at another ripple where they camped for the night, a



Kentucky River palisades
at the mouth of Dix River.

buffalo herd fording the river sank a dugout when one jumped onto the boat. After bailing and raising the dugout, they continued their upriver voyage, stopping to catch fish including a forty-pound catfish. On their way upstream, they met a dozen or more downbound canoes carrying pioneers who had already surveyed their Kentucky land and were returning to Fort Pitt and Redstone (Brownsville) on the Monongahela. When they reached the landing where James Harrod and his companions landed earlier, it had taken them two weeks to canoe up the lower ninety-seven miles of the Kentucky River against "bad navigation, many rapids and strong currents."¹⁰

Leaving the Cresswell and Nourse canoeing party, George Rogers Clark stopped to join Hancock Lee surveying the town of Leestown near the modern site of Frankfort, and at the same time Daniel Boone and his family and friends arrived to establish Boonesborough farther up the Kentucky. The Boone party came overland through Cumberland Gap, opening a trace that became the Wilderness Road, but after reaching the Kentucky, the Boone party also made canoes for their river travel and for recreation. When kidnapped by a war party in 1776, the daughters of Daniel Boone and Richard Callaway were enjoying a canoe trip along the scenic river near Boonesborough.¹¹

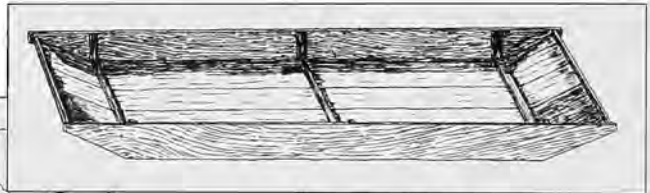
Journals kept by pioneer canoeists and later by flatboatmen reveal that the Kentucky River's natural navigation resembled that on other tributaries of the Ohio River that never had locks and dams built on them. Modern canoeists find described in these journals the hazards they typically encounter on the unimproved tributaries. At low-water stages prevailing in summer and autumn, the Kentucky River dammed itself naturally with gravel bars, islands, and rock ledges forming the ripples. "The springs and streams lessen in June, and continue low, hindering navigation," wrote pioneer historian John Filson, "until November, when the autumnal rains soon prepare the rivers for boats, and replenish the whole country with water."¹²

Called ripples, riffles, or rapids by early boaters on the Kentucky, these navigation obstructions were formed by rocks or sand and gravel deposits, called bars. Ledges of rock thrust up by the valley's active geology, or perhaps rolled into the river from adjacent cliffs, formed natural dams that held deeper pools of water stretching upriver to the next ripple. Tributary streams entering the river slowed and dropped their load of sediment, forming sand and gravel bars or shoals; and as these sediment deposits grew over time they also formed ripples and sometimes became islands. Though the Kentucky drops more than 200 feet in its 255-mile twisting descent to the Ohio, boating down it in canoes resembled passing down a staircase: the natural river had a series of deep, level pools dammed at the ripples where the river's fall was concentrated. Names given to these ripples by pioneer boatmen may still be found on modern maps of the Kentucky.¹³

To pioneer canoeists descending the Kentucky, the ripples posed little obstruction. They merely paddled their canoes into the deepest channel or chute through the ripple and enjoyed a fast ride down the slope; or if the shallows prevented the passage of even a canoe, they stepped out of their craft to lighten it and waded down the slope guiding the canoe with hand or rope. Proceeding upstream, however, the ripples sometimes formed currents too swift for paddling, and at these the canoeists walked along the bank, towing their craft with a rope up the ripple to the deep pool above it, or perhaps landing to portage their supplies and boat around the ripple.¹⁴

At higher stages during "tides," the river completely inundated the ripples, leaving only boils on the surface to indicate their locations. Craft larger than canoes sat deeper in the water and had to await a high-water tide before navigating the Kentucky. Descending the river on a tide merely involved steering the boats to keep them in the channel while letting the current carry them downstream. The steersmen or pilots had to avoid dangers presented by boulders rolled into the river from adjacent cliffs or from the fallen trees, called snags, that could puncture their boat's hull. When passing islands, pilots had to select the deeper of the two channels, and when navigating through river bends they had to keep to the inside because the current, sweeping toward the outside of bends, might force their boats into trees or rocks along the bank. Describing hazards met by boatmen passing Frankfort, John Stuart in 1806 wrote: "We passed Frankfort riffle by taking the right hand shoot [chute], a bad riffle, and in the evening we pass't Elkhorn riffle, the worst on the River; we pull'd hard on the left hand bend & then on the right."¹⁵

River currents floated flatboats to market and their crews only steered the boats.



Ferry flats for crossing the Kentucky River were built as early as 1780

During the 1780s, the pioneers built flatboats to ferry across the Kentucky River and to transport their frontier produce to market. As the name implies, flatboats resembled large wooden boxes with flat bottoms. Pioneers built them by splitting a large log in two, hewing each half to become the timber gunwales, and pinning boards between the two gunwales to form the bottom or hull of their boat. Made large enough to carry a wagon and team of horses, these became ferries for crossing the Kentucky River and were called ferryflats. Richard Callaway was building a ferryflat in 1780 for the first licensed ferry across the

A well-dressed crowd crossing the Kentucky on a ferry. From Charles Hay Collection, Eastern Kentucky University, Richmond, KY.



Kentucky River at Boonesborough when a war party killed him and his companions; his survivors finished the ferryflat, and the ferry operated at Boonesborough until the twentieth century. The size of ferryflats varied, but the Jacks Creek Ferry owned by Richard Perkins in 1810 was typical; Perkins described his ferryflat as a "strong boat, built to carry a loaded-wagon and six horses without ungearing." State government licensed the ferries across the Kentucky River and limited the rates they could charge travelers for passage. These ferries operated until supplanted by bridges during the twentieth century, and by the end of the century only the Valley View ferry established by John Craig in 1785 remained in service.¹⁶

With sides and roof installed atop a ferryflat hull, the pioneers built flatboats to carry their agricultural produce and frontier staples to market, and these flatboats made the Kentucky River the cradle of inland river commerce. An Army officer, seeing these pioneer flatboats descending the Kentucky and Ohio rivers in 1801, remarked that they looked like "floating houses." And another traveler said of the flatboats: "They are of a square form, some longer than others; their sides are raised four feet and a half above water, their length is from fifteen to fifty feet, the two extremities are square, upon one of which is a kind of awning, under which the passengers shelter themselves when it rains."¹⁷



The Valley View ferry in operation.

**NEW-ORLEANS.
WANTED IMMEDIATELY,**

A Number of stout hands, to work our boats down the Mississippi; to whom we will give good wages and generous treatment.

JOHN CROZIER & Co.

Lexington, Nov. 16, 1793.

††† They continue to purchase all kinds of country produce.

John Crozier of Lexington in 1793 employed flatboatmen for commercial voyages to New Orleans.

Except for their wooden construction, flatboats somewhat resembled the single-wide house trailers of twentieth-century Kentucky, and, like the trailers, flatboats often served as mobile homes, carrying pioneer families moving down the Ohio River to settle in Kentucky. Guided with long oars called sweeps, flatboats floated down rivers to their destinations, where they were disassembled to become cabins or barns; lacking engines, they were not well designed for upstream travel against the current. For this reason, few pioneer families ascended the Kentucky River in flatboats to settle; after reaching Maysville or Carrollton on the Ohio, they left their flatboats and traveled in wagons into the Kentucky valley. When the best lands in Kentucky were taken, however, pioneers such as Daniel Boone followed the frontier farther west to Missouri and other states; and these often descended the Kentucky River in flatboats on their way to new homes.¹⁸

Rather than transporting their frontier produce on packhorse or wagons back across the Appalachian mountains to Atlantic coast markets, Kentuckians sought to market their commodities in flatboats down the Kentucky, Ohio, and Mississippi rivers to New Orleans for export. Spanish authorities controlling New Orleans thwarted early efforts to establish this commercial flatboat trade, but in 1787 General James Wilkinson, a founder of Frankfort, went to New Orleans with a flatboat loaded with hams, tobacco, and butter, ingratiated himself with Spanish officers, and sold the cargo profitably. Obtaining a trading permit from the Spanish, he returned to Frankfort and purchased pork, beef, flour, tobacco, and other frontier staples for loading aboard flatboats at the mouths of Hickman Creek and Dix River and at General Charles Scott's town of Petersburg on the Kentucky River. Wilkinson's first fleet of twenty-five flatboats went to New Orleans in 1789, and Wilkinson pursued the New Orleans trade until he returned to military service in 1791.¹⁹

Spanish authorities gradually lifted restrictions on Kentucky's flatboat trade and this commerce blossomed after President Thomas Jefferson purchased the Louisiana Territory in 1803. Dozens of flatboats descended the Kentucky River each spring on the way to New Orleans where the boats and their cargoes were sold and their crews walked home, usually via the Natchez Trace from Mississippi through Tennessee. Scant records do not reveal the number of flatboats

descending the Kentucky, nor their aggregate tonnage, but a few surviving cargo manifests indicate the trade's character. For example, Captain John Miles and his flatboat *Winchester* out of Boonesborough arrived at New Orleans in June 1805 with this cargo: 24 barrels of flour, 500 pounds hemp, 4,000 pounds bacon, 1,000 pounds lard, 440 gallons whiskey, 100 bushels corn, 60 gallons brandy, 80 turkeys, and 10 bushels of potatoes. Most other Kentucky River flatboats, however, also carried hogsheads of tobacco.²⁰

Pioneer boatmen seldom attempted to force flatboats with their flat scow design upriver against currents, and instead conducted the upstream trade on the Kentucky River in keelboats, also called barges. These were long and sleek, ribbed and planked like a ship, with a heavy timber keel and pointed prow to facilitate ascent against the Kentucky's powerful currents. Ranging from thirty to seventy-five feet long and from five to ten feet wide, keelboats had arched cabins covering their cargo and narrow runways along each side. They had masts and sails for use when the wind blew upstream, but usually were propelled by crewmen pushing iron-tipped poles against the river bottom.²¹

Elijah Craig, founder of Georgetown and Port William (Carrollton), dominated the Kentucky River upstream keelboat trade. In 1795 he built a warehouse at the mouth of the Kentucky River and advertised that he would transport commodities upstream to Frankfort for 50 cents per hundred pounds, on to Warwick for \$1.00, and still farther to the mouth of Dix River for \$1.25. Craig also built ropewalks at Frankfort, where he manufactured Kentucky's hemp crop into tarred rope for sale to the ships landing at New Orleans. After delivering merchandise from New Orleans to Frankfort, Craig loaded his keelboats with rope and frontier staples for the return trip downriver. A manifest for his keelboat *Sophia* voyaging from Frankfort to New Orleans in June 1805, for example, listed a lading of 4,000 pounds of tarred rope, 1,600 pounds spun yarn, 50 barrels flour, 28 barrels saltpeter, 4,500 pounds gunpowder, 650 gallons whiskey, 70 gallons peach brandy, 120 pounds candles, 900 pounds bacon, 1,100 pounds tobacco, 250 pounds snuff, 1,000 pounds lard, 320 pounds butter, 89 pairs of shoes, 1 pair of boots, 3 dozen hog skins, and 22 deer skins.²²

With experience gained in building flatboats and keelboats, Kentuckians built sea-going ships to sail to New Orleans and enter foreign trade directly; they launched at least four ships on the Kentucky River in the early nineteenth century. The first was the *Go By*, an eighty-ton sailing schooner built in 1803 at Frankfort. John Instone, an Englishman living on Frankfort's Wapping Street, which he named for a street in London, built this ship at Yeatman's boatyard, and Captain Thomas Jones piloted it down the rivers to New Orleans and into the Caribbean trade, where a British warship seized and confiscated it in 1804.²³

In 1804, John Instone launched his second ship at Frankfort, the eighty-nine ton schooner *Ceres* that sailed to New Orleans under command of Captain Samuel Cummings; and John Melanthy of Frankfort completed the eighty-two ton schooner *Jane*, which Captain Thomas Watts piloted to New Orleans. John Jordan, Jr., a Lexington shipping merchant, built the *General Scott* at Scotts Landing twenty miles upstream of Frankfort near present Tyrone, Kentucky. William Jarvis was master shipwright for this 260-ton sailing ship, which passed down the Kentucky River in May 1805 under the command of Captain Robert Sprigg. The *Ceres* and *Jane* apparently entered the coastal trade out of Baltimore, Maryland, but the *General Scott* took aboard a French crew at New Orleans and sailed for France where British warships sank it. British confiscation of the ships and President Thomas Jefferson's embargo of 1807, imposed on foreign trade to punish the British, followed by the War of 1812, made Kentucky River shipbuilding so risky and unprofitable that it was abandoned.²⁴

To foster its pioneer flatboat, keelboat, and ship commerce, state government licensed warehouses at ports along the Kentucky River for storing and inspecting commodities for export, and as early as 1792 the state legislature considered improving the river's navigation. By removing boulders and fallen trees from the channel and clearing passages through ripples and gravel bars, a less hazardous passage might be opened for the unpowered pioneer watercraft. In 1799, Martin Hawkins, an ingenious Frankfort mechanic, examined the river below Frankfort and planned improvement of its channel. He found seventeen obstructive ripples on the lower river, located at the Fishtrap, Greenup, Essex, and Steele islands near Frankfort and at shoals where creeks entering the river dropped their load of sediment and rocks. He found the most obstructive ripple on the river located at the mouth of Cedar Creek (future site of Lock No. 3) where the stream descended nearly nine feet within a distance of 100 yards. He saw a giant sycamore tree fallen into the river at Clay Lick (future site of Gratz) that entirely blocked the low-water channel, and he estimated the delays to commerce resulting from this single snag had cost boatmen \$3,000.²⁵

Calculating the total fall or descending river gradient from Frankfort to its mouth at 49 feet and 4 inches, Hawkins estimated that removing obstructive snags from its channel would cost five hundred dollars. Dredging rocks and gravel to deepen boat passages through the ripples might cost another thousand dollars, and for the total of \$1,500 the channel below Frankfort could be improved to "render the passage of flatboats perfectly safe and easy." Hawkins suggested these costs could easily be recovered by collecting tolls of one cent per each hundred pounds of cargo from the boatmen and shippers.²⁶

Noting that Virginia and Pennsylvania had chartered corporations to improve river navigation with locks and dams, Hawkins recommended that the Commonwealth charter a company to build locks and dams on the Kentucky River. He asserted a \$10,000 company investment in improving the navigation would allow shippers to steer their boats to the river's mouth early, rather than awaiting the floods of spring, and thereby permit them to reach New Orleans before summer heat rotted their cargoes. By collecting tolls from the traffic, the company could recover its investment plus interest within a century.²⁷

In accordance with Hawkins' recommendation, the state legislature in December 1801 chartered a Kentucky River Company to remove all obstructions impeding boat traffic on the river from its mouth up to its source at the Three Forks (present site of Beattyville). It authorized the company to sell its capital stock worth \$10,000 to county governments along the river, and approved the collection of tolls on the traffic to recover project costs. The company failed to sell its capital stock, however, and accomplished nothing toward improving the river; subsequent efforts to raise the capital through lotteries failed as well.²⁸

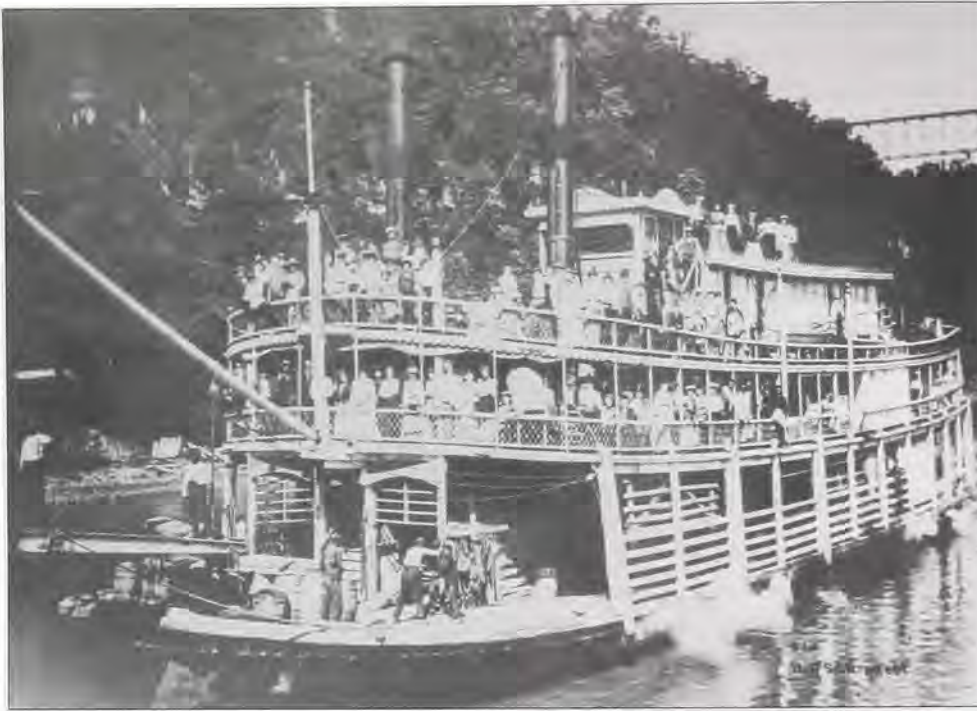
In 1804 a public-spirited citizen made the first recorded successful effort to enhance Kentucky River navigation. Jean J. DuFour, a Swiss immigrant who founded a settlement and planted vineyards near the present site of Camp Nelson, observed flatboats wrecked on a ripple near the mouth of Hickman Creek. To guide boat pilots, DuFour voluntarily planted log cross-beams on the riverbank to point the boatmen toward the best passage through the ripple. Although newspapers urged other civic-spirited citizens to emulate DuFour's example, this initiative apparently met with little response.²⁹

With legislative approval, Martin Hawkins in 1803 constructed a milldam across the right, or eastern, channel around Fishtrap Island at Frankfort, using the water fall at the dam to power a saw and grist mill. In exchange for this privilege, the legislature required Hawkins to clear the left or western channel of obstructions and to guide boats through the channel when necessary. When boatmen still complained that Hawkins' milldam obstructed navigation and the legislature considered revoking his license, Hawkins made a wax model of the island, channels, and dam to demonstrate that his dam was not an obstruction. He mounted it on a board propped at an angle outside the state capitol building, planning to pour buckets of water at the top of the board to run down the wax model, showing the flow patterns through channels past the island and dam. When Hawkins escorted the legislature to see his model demonstration, however, he found that street urchins had stolen the wax to use as chewing gum, and the legislature ordered him to remove his milldam from the river.³⁰

By 1805, flatboats carrying salt and iron to Lexington, Frankfort, and Louisville had begun navigating the Kentucky from its South Fork and Red River tributaries, and this commerce received special attention from the state legislature. The legislature directed that the Red River's navigation be kept open for boats seventeen miles up the stream to the Clarke and Smith dam at the Red River Iron Works (near present Clay City). The Red River charcoal iron furnaces shipped pig iron downriver in flatboats called "iron boats," and cannon balls from these iron works supplied General Andrew Jackson and the Kentuckians at the Battle of New Orleans. From the large furnace at Fitchburg, however, a six-mile-long tramway moved the pig iron in carts to Miller Creek landing on the Kentucky River, where eighty tons filled each iron boat for transport down the Kentucky. The state legislature supported this commerce in competition with iron imported from other states, and the trade later became a justification for building locks and dams on the Kentucky River.³¹

The state legislature supported improved navigation on the South Fork of Kentucky River because it moved flatboats carrying salt downstream to supply Lexington and Frankfort. Used before the advent of refrigeration to preserve meat and foodstuffs, salt was vital to frontier life, and as early as 1775 pioneers had boiled mineral water at Drennon Lick on the lower Kentucky River to make salt. By 1800, John Bates, James White, and James Garrard had opened saltworks in Clay County near Manchester, where they drilled wells for mineral water and boiled the brine in kettles to extract a salt residue. Packing the salt in barrels, they sent it in flatboats called saltboats down Goose Creek and Redbird Fork, which form the South Fork, and on downstream to the Kentucky River markets.³²

Kentucky river saltboats were sixty-foot-long, fourteen-foot-wide flatboats filled with barrels of salt and towed by oxen down Goose Creek and Redbird Fork to the South Fork. At high "tides," the saltboats descended the narrow and rock-strewn South Fork to the Kentucky River, then down the Kentucky 190 miles to Frankfort. They often wrecked on obstructive boulders and snags, a costly loss to Kentuckians who had to buy more expensive salt imported from the Kanawha River salines. To reduce these losses, the legislature in 1810 appointed owners of the Clay County saltworks as commissioners for removing obstructions to the South Fork's navigation, and it subsequently funded additional efforts to improve the South Fork for saltboat traffic. Indeed, the salt commerce also became a principal justification for building locks and dams on the Kentucky River.³³



Steamboats like the *Falls City* carried many passengers on the Kentucky during the 19th century.

The advent of steamboat commerce after the War of 1812 provided another major impetus for improving the Kentucky River navigation. The first steamboat on the inland rivers, the *New Orleans*, steamed down the Ohio along Kentucky's border in 1811, stirring interest in using steam power to move Kentucky's produce to markets and to bring imported merchandise upriver. After the commercially disruptive War of 1812 ended in 1815, steamboats began operating on the Kentucky River. In 1816 a group of Lexington shippers built the steamboat *Kentucky* at the mouth of Hickman Creek (present Camp Nelson) with a steam engine designed by Edward West using a sturdy spring instead of a flywheel to return its piston. When Captain John Armstrong piloted the *Kentucky* on an engine test run against the Kentucky's current, a newspaper reported this steamboat "more than answered the sanguine expectations of her owners and left no doubt on their minds that she could stem the current of the Mississippi with rapidity and ease." It was the second steamboat built in the Commonwealth, and it entered the Louisville to New Orleans trade.³⁴

Early steamboating on the Kentucky developed largely from an Army supply contract with James and Richard M. Johnson (Vice President of the U.S., 1837-1841) of Lexington. The Johnsons in 1818 contracted to supply an Army expedition up the Missouri River, and their contract required that they furnish steamboats to transport "provisions, and munitions of war, detachments and their baggage, or other articles, to the military posts in said waters." To comply with their contract, the Johnsons purchased the steamboats *Johnson*, *Expedition*, *Rifleman*, and *Exchange* built at Ohio and Monongahela River ports. In 1818 they also began construction of the 120-ton, 120-foot long steamboat *Calhoun* at Leestown on the Kentucky near Frankfort. "We hail this," a newspaper commented, "as the commencement of an effort which will exhibit to us the importance of the navigation of the Kentucky River." In a letter to Secretary of War John C. Calhoun, for whom the steamboat was named, Richard Johnson reported the launch of this steamboat at Leestown in March 1819 "attracted the attention of the citizens of Frankfort and its vicinity."³⁵

In April 1819, the Johnsons' steamboat *Expedition* became the first steam-powered vessel to ascend the Kentucky River to Leestown near Frankfort, and later the *Calhoun*, *Johnson*, and *Exchange* also made trips to the Leestown warehouses, taking on hemp rope and other materials supplied to the Army. The Johnsons' steamboats reached St. Louis in May 1819, boarded troops and supplies, and steamed up the Missouri River in company with the *Western Engineer*, an armored steamboat built by the Army Corps of Engineers at Pittsburgh. These steamboats reached Council Bluffs, Iowa, on the Missouri River before Congress terminated the military expedition's funding.³⁶

The Johnsons contracted for construction of a second steamboat, the *Providence*, on the Kentucky River at Leestown in 1819, and Captain Isaac Lansdale of Lexington loaded this boat at Leestown in May 1820 and piloted it to New Orleans. Transporting 150 tons, the *Providence* was 150 feet long and 30 feet wide with a 9-foot draft. In addition to its steam engine, it had two masts and sails, indicating that the shipwrights who had built schooners on the Kentucky River before the War of 1812 also built the early steamboats. Other early steamboats on the Kentucky River included the 106-ton *Governor Shelby*, and the 200-ton *George Madison*, which occasionally ascended the river at high water stages.³⁷

The early steamboats did not attempt ascending the ripples past Fishtrap Island from Leestown upstream to the Frankfort wharf. When the *George Madison* arrived at Frankfort from Louisville in February 1820, therefore, a newspaper reported: "The river being full, the citizens had an opportunity of witnessing for the first time, the operations of a Steam Boat before our town. She returned on the same day, as far as Leestown for the purpose of receiving her loading, and left that place on Monday, the 21st for New Orleans. We understand she was loaded by Col. J. Johnson, with supplies for the government."³⁸

Inspired by the advent of steamboat commerce, Governor Gabriel Slaughter urged the Kentucky legislature to fund the removal of obstructions to navigation from the Commonwealth's rivers. "When it is considered that most of our fertile lands are distant from the Ohio, and that we are dependent on our smaller rivers for the transportation of the greater part of our surplus production to market," Slaughter urged, "the improvement of their navigation seems to demand the serious consideration and attention of the legislature."³⁹

Learning that the Frankfort and Leestown warehouses exported commodities worth \$324,164 in 1818 and the five warehouses along the lower river exported tobacco worth \$122,500, while these warehouses also received \$312,630 worth of imported sugar, salt, wine, iron, fish, and assorted dry goods and groceries by river, the Kentucky legislature appropriated \$40,000 for removing obstructions from river channels, allotting \$10,000 of this fund to improving the Kentucky River and its South Fork. Dividing the Kentucky into three sections for administration, state commissioners employed workers and purchased axes, crosscut saws, and blasting powder for the project. They cleared snags from the Kentucky's channel, removed fishtrap dams, blasted away obstructive rocks, and built timber dams to guide river flow and boats through ripples and shoals. Much of the appropriation went to excavate a deeper channel past Fishtrap Island to ease the passage of steamboats from Leestown up to the Frankfort wharf. The legislature provided no funds to maintain this project, however, and floods soon filled the excavations with gravel and washed new snags and boulders into the river's channel. Subsequent assessment noted that this project was undertaken "without scientific surveys and the consequence was a useless waste of money."⁴⁰

Looking down from high bridges spanning the river, twentieth-century travelers see a constant ribbon of slackwater, but in its natural condition the Kentucky River provided only seasonal access to markets. Droughts and low-flows exposed its ripples and prevented commercial navigation from July through October during most years, and natural obstructions made hazardous the pioneer flatboat, keelboat, ship, and steamboat commerce during the high-water tides from November to June. Even in pioneer times, Kentuckians hoped that the river might be developed into a more reliable artery of civilization.

Experience with the open-channel project of 1818 on the Kentucky revealed that converting the river into a reliable commercial artery would require major expenditures both for construction and maintenance. To make the river serve Kentucky's demands for access to inland river markets, the Commonwealth needed to employ professional engineers who could plan and implement the most advanced navigation improvement projects of the time. Whether Kentucky should embark on such costly and experimental slackwater-navigation projects became a major political issue during the early 1820s, the "Era of Good Feeling."

Kentucky River

2

INTERNAL IMPROVEMENTS

Whatever facilitates and cheapens the process of exchanging one commodity for another, increases the capacity to produce; enriches the nation; adds to her offensive, or defensive, strength; diffuses happiness, comfort and joy amongst her own citizens; increases their love of home; affords them leisure for the cultivation of the mind; enables them to mingle, without defined limit, in the affairs of active practical life; exalts their character and that of the State, to the loftiest summit of human elevation.

Thomas Metcalfe, 1830

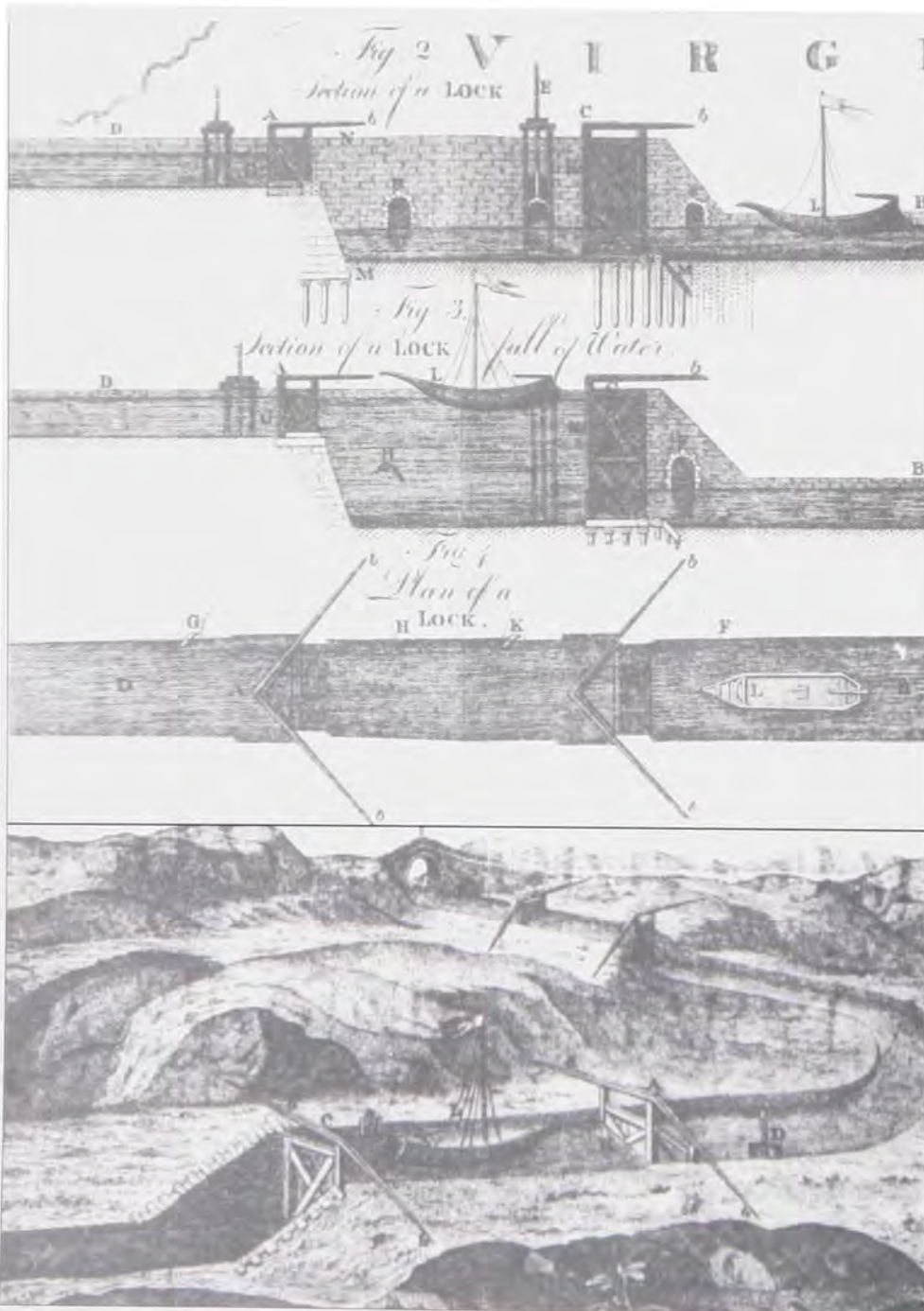
The Commonwealth in 1835 initiated a sweeping state-wide program of transportation projects, then known as internal improvements, by creating a Board of Internal Improvement to manage the projects and borrowing the capital needed for project construction. Along with the Green and Licking rivers, the Kentucky River became one of the Board's three major waterway transportation projects that aimed to link the interior of the state with the Ohio River by providing slackwater navigation for steamboat commerce. After fiscal constraints abruptly ended construction of these slackwater projects along with development of the entire state transportation system during the 1840s, Kentuckians asked why the Commonwealth had embarked on internal improvements. Who was to blame? As often is the case in Kentucky, the answer may well be traced to politics.

Public and political support for state internal improvements, inspired by similar transportation programs in other states, evolved slowly in the Commonwealth during the twenty years between the end of the War of 1812 and 1835. In 1818 the state legislature funded a largely unsuccessful program to clear the state's rivers of obstructions, and during the 1820s it initiated specific transportation improvements piecemeal, starting with turnpike roads and the Louisville and Portland Canal. The initiative expanded in 1830 to include the state's first major railroad, continued in 1833 with funding for building locks and dams for the Green River slackwater navigation, and culminated in 1835 with formation of Kentucky's Board of Internal Improvement to borrow capital for development of a broad system of public works that included the Kentucky River navigation. Although these transportation projects initially drew bipartisan support, they became closely associated with the Whig party, led by Henry Clay nationally and by Governors Thomas Metcalfe and James Morehead at the state level.

In 1821 the Commonwealth first assisted turnpike road projects by purchasing stock in individual turnpike companies to match the private investments. The state in 1825 purchased stock in the corporation building the Louisville and Portland Canal at the Falls of the Ohio. In 1830 it funded construction of the Lexington and Ohio Railroad, and in 1833 it provided initial funding for planning locks and dams on the Green River. When its efforts to obtain federal funds for transportation projects failed, the Commonwealth began the projects with its own resources and in 1835 Kentucky's Whig party leaders initiated a comprehensive program to develop a state-wide transportation system. A major element of this system was the Kentucky River project, designed to provide year-round slackwater navigation for steamboat commerce through the state capital and central Bluegrass upstream to the mountains. The origins of the Kentucky River slackwater navigation lie in the evolution of the state's internal improvement program and the rising political fortunes of Kentucky's Whig party.

Kentucky's internal improvements originated during what historians call the "Era of Good Feeling," the administration of President James Monroe from 1819 to 1824 when the nation enjoyed but one political party, the Democratic Republicans led by Henry Clay of Kentucky. As enunciated by Clay, the American system aimed to make the nation self-sufficient. Government would encourage manufacturing within the United States, stifle foreign competition by increasing taxes or tariffs on imported commodities, and support internal improvements, meaning transportation projects, to bind the nation together, foster trade and economic prosperity, and enhance national defense.¹

Even John C. Calhoun of South Carolina, later a famed states' rights advocate, supported national internal improvements during this era; and as Monroe's Secretary of War he penned a rationale for government sponsorship of internal improvements: "It is in a state of war, when a nation is compelled to put all of its



A sketch made in 1790 of a navigation lock . Courtesy of L.R. Johnson

resources in men, money, skill, and devotion to country into requisition, that its Government realizes in its security the beneficial effects from a people made prosperous and happy by a wise direction of its resources in peace."²

During President Monroe's administration, at the urging of Secretary of War Calhoun and through legislation sponsored principally by Henry Clay of Kentucky, the U.S. Army Corps of Engineers initiated internal improvements of national significance. The Corps administered construction of the National Road, the first interstate highway extending from Cumberland, Maryland, across Virginia, Ohio, Indiana, and Illinois to St. Louis (later US Highway 40). It also surveyed a southern route that forked off the National Road near Zanesville, crossed the Ohio River at Maysville, Kentucky, and passed through Lexington and Nashville on the way to New Orleans. In Kentucky, this southern route became known as the Maysville Road, but Kentucky and other states, rather than the federal government, eventually built this highway because President Andrew Jackson vetoed its funding.³

National improvement of river transportation also began in Monroe's administration. Impressed by the reinforcements and supplies delivered via the Ohio and Mississippi rivers to General Andrew Jackson during the Battle of New Orleans in 1815, postwar defense planning by Secretary of War Calhoun and the Army Corps of Engineers called for improving Ohio and Mississippi river navigation as logistical routes for defending the Gulf Coast. The Corps of Engineers surveyed these rivers in 1821, devised plans for clearing their navigation channels, and reported favorably on the work as a national project. When congressional opponents complained these rivers were unimportant to American foreign commerce, Henry Clay of Kentucky retorted that the Ohio and Mississippi rivers "are our inland seas," vital to foreign and interstate commerce. Thanks largely to Clay, Congress in 1824 funded the first federal improvement of Ohio and Mississippi river navigation, assigning this and other western inland river improvements to the Army Corps of Engineers.⁴

Although the President and Congress sought to limit federal transportation projects to those with national significance, they fostered state internal improvement efforts through the Survey Act of 1824 allowing states to call on the services of the Army Corps of Engineers for transportation surveys. Before 1825, Corps officers were the sole professionally trained engineers in the nation, and at state requests they surveyed many early railroad and canal projects built by the states and private corporations. Under aegis of the 1824 Survey Act, the Corps sent officers to Kentucky in 1828 at the Commonwealth's expense to survey the Kentucky, Green, and Licking rivers for navigation.⁵

From the Kentucky Reporter,

INTERNAL IMPROVEMENT

Lieuts. *Trumbull, Grayson and Buford*, U.S. Engineers, passed thro this place on Saturday last, having on that day, completed a most minute and laborious survey of the Kentucky river from its mouth to Boonsborough, a distance of 197 miles. We understand that they were unable to carry their boat higher up than the mouth of Sugar Creek and from the lateness of the season and other causes, consider it impracticable to make a survey or examination of either of the other rivers, mentioned in our late act of Assembly, this year. They proceeded to Washington on Monday, and will we presume make their report to the Department of War in time to be furnished to the Legislature early in the next session.

From the known industry and talents of the above named officers, we rely that their report will be able and satisfactory. If the desired improvement of our principal water courses, is considered practicable at a reasonable expense, it should be forthwith commenced with an energy worthy of the state and the deep interests involved -- if not, we must turn our attention to rail roads and turnpikes, as substitutes. C.

News report of the Corps of Engineers' completion of the 1828 survey of Kentucky River.

Although Kentucky in 1828 hoped to obtain federal funding for transportation projects including the Maysville Road and improved navigation on the Kentucky, Green, and Licking rivers, the Commonwealth's internal improvement program found its model in transportation projects completed in other states. Success of New York's Erie Canal, linking New York City with Lake Erie, inspired the "canal craze" of the 1820s, when many states emulated New York. The construction of canals connecting Lake Erie with the Ohio River began in Ohio and Indiana, and Pennsylvania completed a canal from the East coast across the Appalachians to Pittsburgh. In the South, Virginia built a canal from the James River to the Appalachians, planning its extension to the Ohio River via the Kanawha. Alabama built a canal bypassing Muscle Shoals, the falls obstructing Tennessee River navigation, and studied another to link the Tennessee with the Tombigbee River.⁶

In Kentucky, the Louisville and Portland Canal Company, a quasi-public corporation with combined federal, state, and private funding, began construction in 1825 of a canal bypassing the Falls of the Ohio, a major obstruction to boat traffic at Louisville. Completed in 1830 with three locks in a series to overcome the gradient or fall of the river, the Louisville and Portland Canal afforded passage around the Falls for small steamboats. Tolls collected from boats using the canal produced large dividends on the investment and retired the principal by the onset of the Civil War.⁷

Because the Commonwealth's principal interstate commerce followed the Ohio River south to New Orleans or north to Pittsburgh, Kentuckians had little interest in transmontane canals of the sort built in New York and Pennsylvania. Although Kentucky engineers surveyed a potential canal route linking the Kentucky River with the Atlantic coast via the Tennessee and Savannah river systems, this project never attracted major public support. Rather than canals, internal improvements advocates in Kentucky urged the construction of turnpikes, railroads, and river navigation projects to afford its interior counties better access to Ohio River markets.⁸

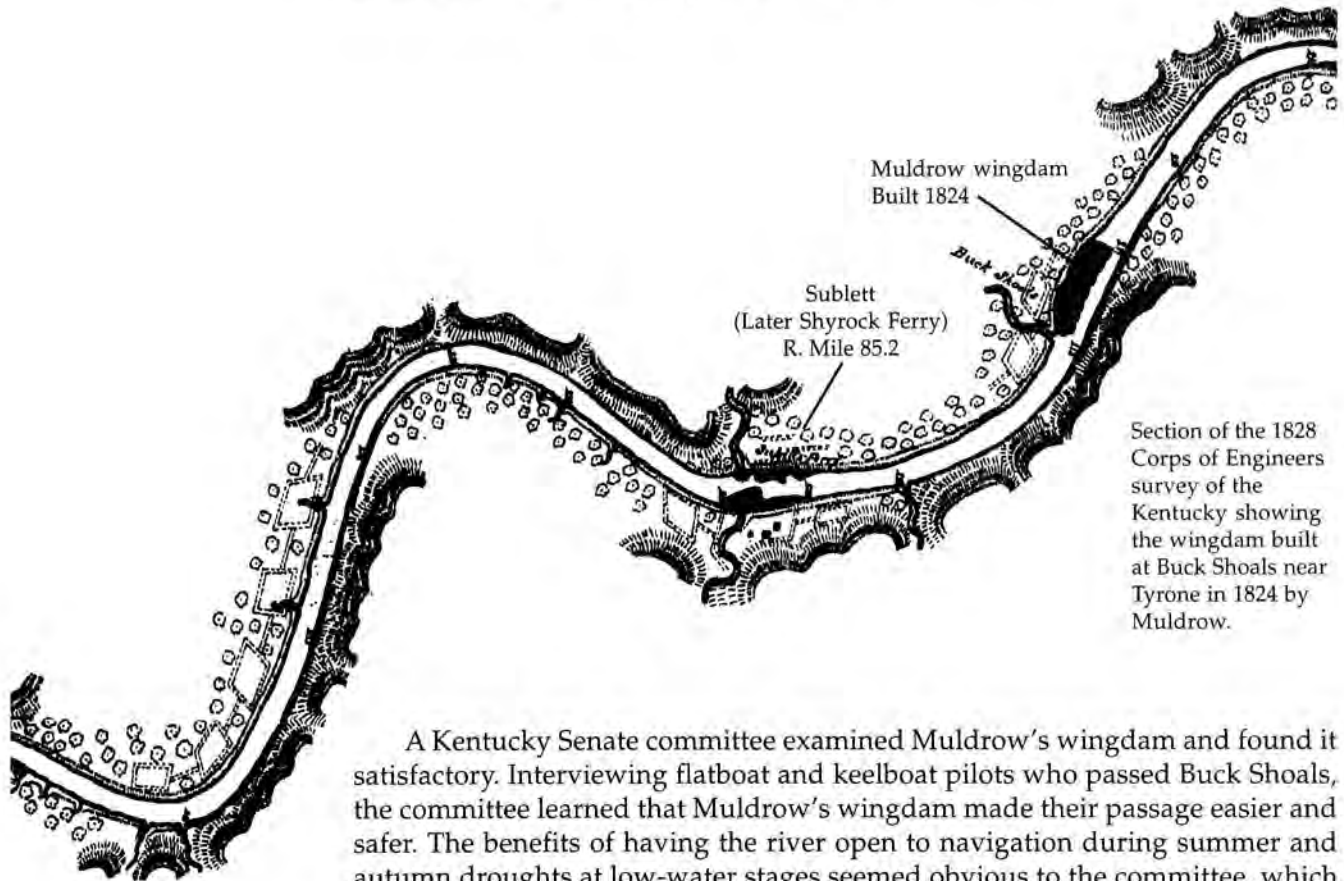
Prior to the "Era of Good Feeling" the Commonwealth had done little to improve its access to markets. The legislature authorized counties and corporations to collect subscriptions and conduct lotteries for transportation project funding, and it enacted laws encouraging road construction by local governments and discouraging the obstruction of river navigation. The state provided no significant funding for transportation projects, however, except in 1818 when it appropriated \$40,000 for clearing obstructions from the Kentucky, Green, Licking, Cumberland and other streams. Its first appropriation for turnpike roads came in 1821, when it funded grading Muldraugh Hill on the road from Louisville and Lexington to Nashville.⁹

A boost for Kentucky's internal improvements program came in 1824, when Governor Joseph Desha called for state transportation projects emulating those in New York and other states. He asked, "Shall Kentucky rest supine while the whole nation is in activity?" Urging state funding for the Louisville and Portland Canal at the Falls of the Ohio, Desha also asked the legislature to reinvest the state's banking reserves in turnpike roads, specifically a road from Maysville through Lexington to Louisville. In his opinion, tolls on the traffic would amortize the investment within a few years and, indeed, eventually return sufficient dividends to "entirely relieve the people from the burden of taxation."¹⁰

After the Commonwealth joined private investors and the federal government in 1825 to fund construction of the Louisville and Portland Canal, Governor Desha regretted that Kentucky had not funded this canal entirely as a state project. He predicted the canal would prove profitable, as indeed it did after its completion in 1830, paying large dividends to stockholders and even retiring the principal.¹¹

As an experiment in 1824, the Commonwealth gave \$300 to Andrew Muldrow to build a wingdam project at Buck Shoals, a major impediment to Kentucky River navi-

gation near the modern site of Tyrone. Muldrow, who represented Woodford County in the State Senate, sought to confine the river's low-water flow to a single well-defined channel at Buck Shoals. He built an experimental wingdam, so called because it extended in a curve from one bank to midstream, and from the heights it resembled the arc of a bird's wing. He drove double rows of timber piling and filled space between the rows with stone, forming a 322-yard long and two-foot high dam. By diverting the river's low water flow to one side of the river, it deepened the channel past the dam. Moreover, the increased speed of the river flowing past the dam dragged gravel from the channel and deposited it behind and below the wingdam.¹²



Section of the 1828 Corps of Engineers survey of the Kentucky showing the wingdam built at Buck Shoals near Tyrone in 1824 by Muldrow.

A Kentucky Senate committee examined Muldrow's wingdam and found it satisfactory. Interviewing flatboat and keelboat pilots who passed Buck Shoals, the committee learned that Muldrow's wingdam made their passage easier and safer. The benefits of having the river open to navigation during summer and autumn droughts at low-water stages seemed obvious to the committee, which reported it a major benefit to the shippers of tobacco, pork, flour and whiskey. These shippers, the committee reported, "had to combat with the seasons, and has beheld his well arranged plans and reasonable hopes of successful enterprise, marred and dissipated by the want of rain and the lowness of the streams upon which his property was to be floated. His tobacco has been prepared for market in time, but for want of means of transportation, it has remained embargoed in the heart of the country, until the season was so spent that on its arrival at Orleans, the demand was over."¹³

Pointing to the Ohio River as Kentucky's principal marketing outlet and noting that a third of the state's exports entered the Ohio from the Kentucky River, the Senate committee recommended funding more wingdam construction at twenty shoals or ripples in the river below Frankfort at an estimated cost of \$6,000, together with subsequent extension of this work from Frankfort upstream to Boonesborough. To start, the committee suggested the Governor should appoint a committee to survey the river from Muldrow's wingdam at Buck Shoals to its juncture with the Ohio, examining each obstructive ripple to determine the amount of fall and estimating the cost of wingdams needed to enhance a low-water navigation through the ripples.¹⁴

No action toward improving Kentucky River navigation followed, and during the next legislative session a Senate committee chaired by Robert Wickliffe again reviewed the wingdam plans. Wickliffe declared earlier efforts to improve the Kentucky River had failed for two reasons: too many incompetents had superintended the channel clearance projects, resulting in clearance of only the high-water channel "instead of improving the navigation in the shoals and ripples of the streams." Wickliffe urged the Commonwealth to employ professional civil engineers to survey public transportation projects, and he called for a "fair trial" of Muldrow's wingdam scheme. He asserted that Muldrow's successful wingdam at Buck Shoals indicated similar structures might improve the entire river for merely a few thousand dollars.¹⁵

The Wickliffe committee also studied the federal government's constitutional powers for funding transportation projects, then a significant political issue. Because the Constitution gave the federal government powers to establish post offices and post roads, to regulate interstate commerce, and to provide for the general welfare, Wickliffe argued it necessarily followed that the United States had the power to build and maintain interstate thoroughfares. Observing that the Army Engineers commonly built roads ahead of the advancing armies on the frontiers, Wickliffe asserted that the "power to march an army through a state, presupposes the power to make the roads on which they are to march."¹⁶

A Kentucky House committee was no less emphatic than Wickliffe: "The situation of the country at this time, imperiously demands, that a system of INTERNAL IMPROVEMENTS should be commenced within the state, without delay, under the patronage, and with the aid of constituted authorities." Noting the federal budget then was in the black, accumulating millions of dollars in surplus, the House committee supposed this surplus might be returned to the states for transportation projects. If Kentucky initiated its own transportation projects, the committee predicted the U.S. Congress would provide matching funds. It insisted the Commonwealth should employ professional engineers and should request assistance from the U.S. Army Corps of Engineers, especially for surveying a branch of the National Road from Maysville through Lexington toward New Orleans.¹⁷

Congressman Thomas Metcalfe, representing the Maysville district in 1827, introduced a bill providing federal funding for building the Maysville Road. When Congress did not enact it, Metcalfe persuaded the Secretary of War to order a survey of routes leading from the National Road at Zanesville to Maysville through Lexington and Nashville to Florence, Alabama. Major Stephen H. Long of the Corps of Engineers completed this survey during the summer of 1827, providing a useful report on the route.¹⁸

Elected governor in 1828, Thomas "Stonehammer" Metcalfe vigorously supported internal improvement projects. Lacking much formal education, Metcalfe earned his nickname as a stone mason and contractor for massive stone masonry structures. After leading Kentucky volunteers during the War of 1812, he entered Congress during the Monroe administration and made his reputation as an advocate of Henry Clay's national internal improvements program. In his first message as governor, Metcalfe urged state funding for internal improvements, especially the Maysville to Lexington turnpike road, declaring that transportation projects benefited merchants and farmers and also provided "certain and profitable employment" for laborers.¹⁹

Mentioning that Pennsylvania, New York and other states had borrowed heavily to fund their public works, Metcalfe predicted Kentucky's investments in transportation projects would attract federal matching funds. Because South Carolina, Mississippi, and other Southern states objected to federal transportation project

funding as an unconstitutional extension of federal powers, Metcalfe declared that these states had the right to express opinions but not the right to obstruct federal laws. If carried to the extremes, he warned that this obstruction "would amount to a virtual dissolution of the Union—if resisted, would lead to civil war."²⁰

Metcalfe's plea for state transportation projects found support in Kentucky's legislature, notably from James Guthrie heading the House internal improvements committee. Guthrie concurred with Metcalfe's recommendations and went even farther. He wanted not only the Maysville Road built, but every miry, impassable road in the Commonwealth paved with stone. Although Kentucky had no need of canals like those in New York and Pennsylvania, Guthrie declared the Commonwealth had several rivers pouring into the Ohio that could be made navigable year-round through the construction of locks and dams. These slackwater projects would provide work for laborers, better market access for merchants and shippers, and enhanced real estate values, making Kentuckians generally more "prosperous and happy."²¹

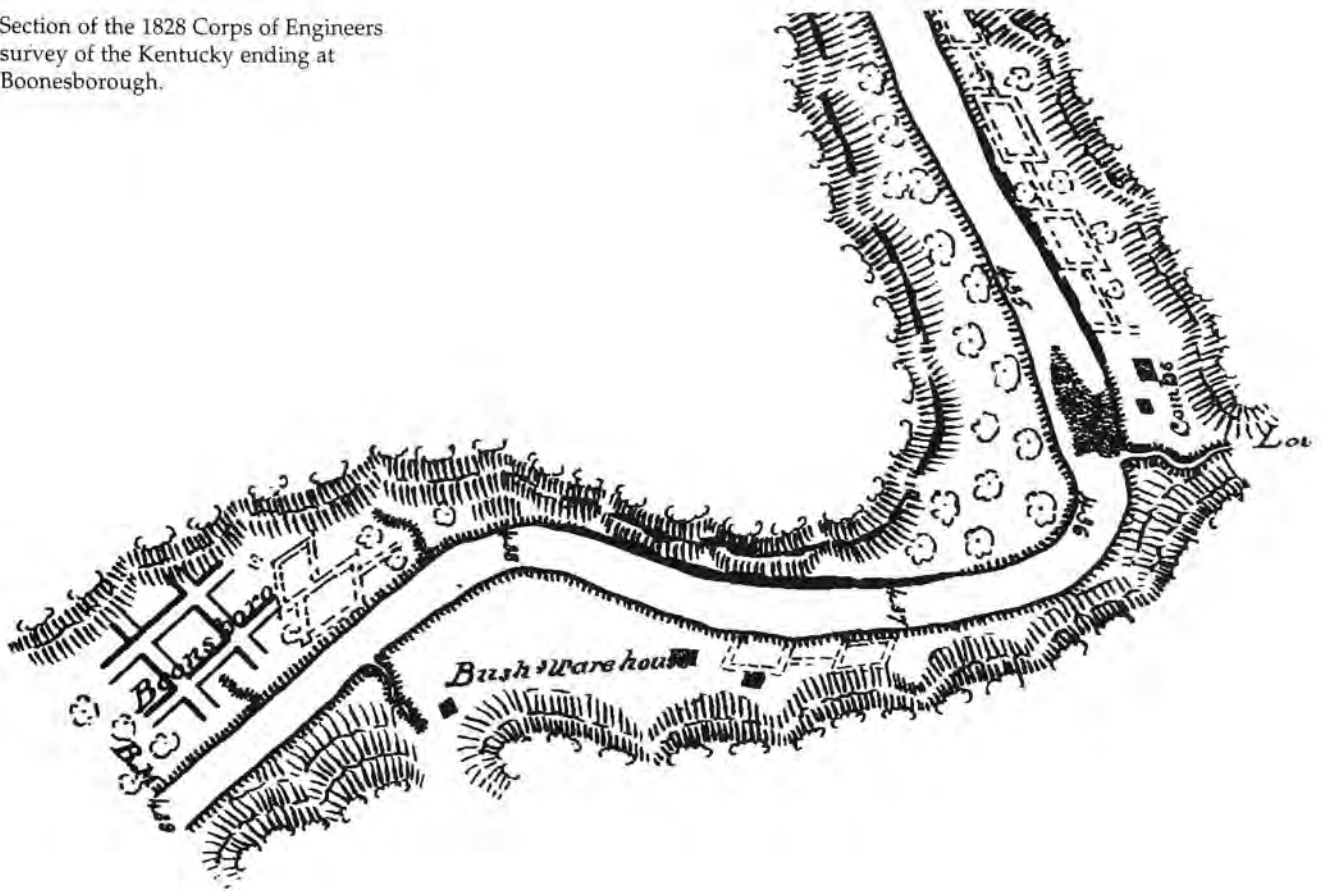
Guthrie estimated the Commonwealth had \$700,000 in bank reserves that should be invested in transportation projects, matching private investments on a fifty percent cost-sharing basis. Tolls collected from traffic on these public works might return six percent on the state's investment, yielding an additional \$40,000 annually for similar projects. He and his committee recommended the formation of a board of internal improvement to manage the state's transportation investments. They also recommended that Kentucky request matching funds from the federal government to build the Maysville Road.²²

Guthrie's unequivocal support for internal improvements marked the original broad bipartisan support for such projects in Kentucky. After the disputed presidential election of 1824 split the Democratic Republican party into factions, the followers of Andrew Jackson became the Democratic party while followers of Henry Clay and John Quincy Adams became the National Republicans, later dubbed the Whig party. Guthrie became a Democratic party leader, was later elected to the U.S. Senate and served as president of the Louisville and Portland Canal Company and the Louisville and Nashville Railroad. When Whig party leaders during the 1840s faced growing public criticism of their internal improvement policy, they pointed to early support for this policy by Guthrie and other Democrats.²³

At Kentucky's request, Congress considered cost-shared funding for the Maysville Road during early 1828. The U. S. House of Representatives enacted a bill for the purpose, which lost in the Senate by a single vote. If the bill had passed then, President John Quincy Adams might have signed it. When Congress again enacted a similar bill in 1830, Democrat Andrew Jackson had become President and his veto of the Maysville Road became a landmark of his administration.²⁴

Kentucky established a Board of Internal Improvement to manage its transportation investments in 1828. Later called the temporary board, it consisted of members of the legislature including Richard Buckner, William Owsley, and Chilton Allan. Buckner became the Whig gubernatorial candidate in 1831; Owsley became governor in 1844; and Allan, a wheelwright from Winchester, was elected to Congress in 1830 as a Whig. This temporary Board managed the state's purchases of stock in private companies building turnpike roads in Kentucky, including a \$200,000 investment for building the Maysville Road. Eventually this temporary board and its permanent successor invested a total of \$2.5 million on a fifty-percent matching basis in the construction of 652 miles of turnpike roads, and historians later considered it to have served as Kentucky's first highway commission.²⁵

Section of the 1828 Corps of Engineers survey of the Kentucky ending at Boonesborough.



The Board of Internal Improvement had responsibility for waterways transportation projects as well, and in February 1828 it requested the U.S. Army Corps of Engineers to survey navigation on the Licking, Green, and Kentucky rivers with the Commonwealth reimbursing the survey costs. Under authority of the Survey Act of 1824 and with approval from President John Quincy Adams, Colonel Charles Gratiot, Chief Engineer of the Army, assigned the river navigation surveys to Lieutenant William Turnbull assisted by Lieutenants John B. Grayson, Napoleon B. Buford, and Campbell Graham. They surveyed the Kentucky River in 1828 and the Licking and Green rivers in 1829.²⁶

Lieutenant Turnbull and his team arrived in Kentucky at the end of July 1828, conferred with the Board of Internal Improvement, and proceeded with their survey of the Kentucky River while it was at a low stage and its obstructive shoal ripples were exposed. Traveling in small craft, the Engineers measured distances along the river, establishing bench marks and running levels to ascertain the river's gradient or fall at each ripple. By the first of September, they completed their survey of the lower sixty-six miles of the river to Frankfort and by Halloween they reached Boonesborough, 176 miles upstream of the Kentucky's mouth. Returning to Washington, they prepared maps, profiles, and their survey report, submitting copies to the Chief Engineer and to Governor Thomas Metcalfe. For its time, the survey map was highly accurate, clearly marking every ripple or shoal in the river, listing the distances and stream gradient, and even delineating topographic features and town plats along the river's banks.²⁷

In his review of the survey, Colonel Charles Gratiot explained that Kentucky River navigation was obstructed chiefly by sand and gravel bars deposited in the channel by tributary streams. Gratiot suggested that wingdams, of the sort built by Major Stephen Long for the Corps on the Ohio River and by Andrew Muldrow

at Buck Shoals on the Kentucky, might be the best means of improving the Kentucky's low-water navigation. He concurred with Lieutenant Turnbull's recommendation that an experimental wingdam be built on the Kentucky at the mouth of Big Benson Creek, where a deposit of sand and gravel called Fishtrap Island blocked low-water navigation. Because this obstruction was near Frankfort, Kentucky's Board of Internal Improvement could supervise the dam's construction and monitor its effects. Commencing on the right bank and extending 240 yards downstream to encompass the island, this wingdam would require placing about 10,740 perches of stone at an estimated cost of a dollar per perch.²⁸

Reviewing Gratiot's proposal, the Secretary of War recommended that Congress appropriate \$10,740 for building the wingdam at Frankfort. This would test the value of wingdams for improving Kentucky River navigation and, indeed, for other tributaries of the Ohio. Soon after this recommendation however, President Andrew Jackson was inaugurated, and his internal improvement policy was more restrictive than that of John Quincy Adams and Henry Clay. Jackson quickly vetoed bills affording federal funding for Kentucky's Maysville Road and the experimental wingdam on the Kentucky River, along with bills for improved navigation on the Monongahela, Wabash, and other rivers. Jackson's veto created an uproar in Kentucky. Members of the newly formed Whig party proclaimed the President had vetoed the welfare of Kentucky, and the new Democrats replied that Jackson might not have vetoed the Kentucky River appropriation had it not been included in a bill that also funded more objectionable projects.²⁹

President Jackson sought to restrict federal funding for river navigation projects to streams which had official ports of entry or customs houses along their courses. Under this restriction, federal projects on the Ohio and Mississippi rivers continued sporadically, but the sole Ohio River tributary with a federally funded project during Jackson's regime was the Cumberland River in western Kentucky and Tennessee, which had an official port of entry at Nashville and also flowed past Jackson's home near Nashville. Thus, Jackson's policy allowed the Corps of Engineers to build wingdams on the Cumberland, but not on the Kentucky River. "Of all shallow pretenses for high handed and outrageous favoritism," protested a Kentucky Whig, "this idea of a port of entry is the most flimsy."³⁰

"Canals you cannot make, but your roads and rivers may be improved," announced Governor Thomas Metcalfe in his 1830 message to the legislature. Metcalfe renewed his request for state-funded internal improvement projects. In addition to turnpike roads, Metcalfe specifically requested state support for the "noble" project of the Lexington and Ohio Railroad Company, formed to build the state's first major railroad from Lexington to Frankfort and on to Louisville, and for a project promoted by James R. Skiles and Warren County interests to improve Green and Barren river navigation up to Bowling Green. Metcalfe became the first state official to urge that the Commonwealth borrow money to fund its transportation projects. He asked whether Kentucky would proceed with these vital projects, or "sink down by supineness and inactivity, until she becomes a bye-word and a reproach to her sister States, a mere nuisance in the way of the intercourse of all enterprising citizens."³¹

Whig leader James Morehead, chairing the Kentucky House committee on internal improvements, seconded Metcalfe's proposal that the state borrow money to build transportation projects. Analyzing state fiscal resources and noting that the first completed section of the Maysville Road had netted a five percent profit, Morehead asserted the Commonwealth could well afford to borrow \$500,000 to invest on a fifty-percent matching fund basis in private transportation companies. He emphasized that other states had borrowed heavily to fi-

nance transportation projects and asked why Kentucky lagged behind. "Situ-ated as the State of Kentucky is, having a good soil, favorable climate, an indus-trious, enterprising, and above all, an intelligent population; intersected by a variety of rivers, capable of great improvement of navigation; furnishing, in abun-dance, the staple, or raw material, calculated to sustain manufacturers of the most profitable kind," Morehead declared, "in a word, with all the facilities, if we would but command them, that can render a people prosperous, indepen-dent and happy, the most powerful motives stimulate us to prompt and vigorous action." Morehead demanded that Kentucky plan a comprehensive transporta-tion system for its people.³²

Although Kentucky elected Whig James Morehead as its lieutenant gover-nor in 1832, Richard Buckner, the Whig gubernatorial candidate, lost the election to Democrat John Breathitt. Political divisions over internal improvements had yet to affect Kentucky, however, and Governor Breathitt advocated continued state investment in the Maysville and other turnpike roads and urged state fund-ing support for two additional transportation modes: the Green River navigation project and the Lexington and Ohio Railroad.³³

When President Jackson vetoed the Maysville to Lexington Road, Lexington merchants, encouraged by success of the Baltimore and Ohio Railroad, organized a railroad company to connect their city through Frankfort with the Ohio River at Louisville. On rails, one horse could pull as much freight as five on turnpike roads. Thomas Metcalfe drove the first railroad spike in 1831 and the company ordered iron rails from Baltimore shipped to New Orleans and up the rivers to Frankfort. Metcalfe also rode a horse-drawn railcar in 1832 over the first com-pleted railroad section. When this first section's costs exhausted private funding, the railroad company sought state assistance, requesting that the state back com-pany loans borrowed from New York banks at five percent interest.³⁴

At Governor Breathitt's request, the legislature considered aiding the rail-road. A House committee reported the Lexington and Ohio Railroad had com-pleted six miles of track at a cost of \$124,000 and railroads seemed to fit Kentucky's needs better than canals. It recommended state backing for loans to the railroad, accepting the railroad's property as collateral. If the State of Ohio could borrow five million dollars to open its canals, is it too startling to ask, the committee queried, "that Kentucky should pledge her credit for much less than a half mil-lion, to aid in furnishing a facility of intercommunication among her own citi-zens, much superior to canals?"³⁵

Another committee reporting favorably on state investments in transporta-tion projects elaborated the Whig rationale for internal improvements: "Employ-ment would be given to hundreds—nay to thousands of our citizens—a market is opened for the products of the farmer's toil—the property of the country is enhanced in value—the price of transportation is diminished as the facilities are increased—agriculture and commerce flourish—and yet the public money, thus vested in stock and thrown into circulation, remains the property of the people, yielding a revenue of perhaps 10, 12, or 15 per cent."³⁶

State government purchased \$200,000 of the Lexington and Ohio Railroad stock in 1833, and the railroad thereby became the first transportation mode ben-efitting from capital borrowed on state credit. With state government acting es-sentially as cosigner on its loans, the railroad borrowed another \$150,000 at seven percent from Eastern banks. For backing these loans, the railroad mortgaged its property to the state with power to foreclose if timely loan payments were not forthcoming. This state sponsorship made possible completion of the railroad from Lexington to Frankfort at a cost of \$370,000 in 1834.³⁷

In addition to the railroad, Governor Breathitt selected the Green River navigation improvement for state support, and in 1833 the legislature agreed to pay engineers employed to plan slackwater navigation on the Green and Barren rivers which would provide year-round navigation to Bowling Green. This was a bold experiment because construction of locks and dams for slackwater navigation had not previously succeeded on tributaries of the Ohio River, and some professional engineers considered it impossible. Efforts by English engineers to build locks and dams on the Avon, Severn, Thames, and other rivers had failed because floods and ice flows destroyed the structures. Mentioning these failures, William Weston, an English engineer employed on Pennsylvania's canals, questioned whether locks and dams could ever be built on American rivers where "floods are more violent, and accompanied by ice in greater quantities."³⁸

Creating slackwater navigation on a river required building a series of dams across the river, each dam holding ponded (impounded pool) water that was slack, without much current. Near the upper end of each pond, another dam formed another pond, and hence the profile of a slackwatered river resembled a staircase with the dams serving as the risers. At the dams, navigation locks with gates at each end raised or lowered boats from one pond to another. As William Weston explained: "The usual method of making rivers navigable is to throw dams across the stream in the most convenient situations, and to build a lock in a collateral channel, to enable the boats to pass from one pond to the other. To obtain the necessary depth of water, the bed of the river, at the tail of each lock, must be deepened, or the water raised so much by the next dam to effect the same purpose."³⁹

Although pioneers in Kentucky and throughout the Ohio Valley built thousands of timber or stone masonry milldams to develop water power for grinding grain, sawing lumber, and manufacturing, they built their dams on small streams or behind islands on larger streams where the dams were reasonably safe from destruction by floods, scour, and ice. Dams built across major rivers that were several hundred feet wide were soon destroyed, washed out by floods and erosion, or cut down by ice and drift. This was the case on the first slackwater navigation project ever attempted west of the Appalachians.

In 1818, Virginia chartered the Monongalia Navigation Company to build a slackwater navigation project on West Fork of the Monongahela River. John George Jackson, brother-in-law to President James Madison, headed this project, which sought to provide year-round navigation from Clarksburg on the West Fork downstream to its juncture with the Monongahela River (in present West Virginia, part of Virginia until 1863)). Jackson and his company had completed six timbercrib, stone-filled dams across the West Fork by 1824 when a flood destroyed them, abruptly ending the first slackwater navigation project in the Ohio Valley.⁴⁰



Pioneers built many mills for water power like this mill and dam on the North Fork in Perry County.

Pennsylvania canal engineers had better success on the Conemaugh and Kiskiminetas rivers near Pittsburgh. After opening the Pennsylvania canal up the Susquehanna River valley and building a tramway incline to carry boats over Allegheny mountain into Johnstown on the Conemaugh River, the engineers found the Conemaugh and Kiskiminetas valleys below Johnstown too narrow for building the canal on to Pittsburgh. Necessity required that they build dams and locks in the riverbeds, and they accomplished this so well that, in addition to canalboats, the slackwater carried small steamboats upstream. This success led to construction of lock and dam slackwater projects on other streams in western Pennsylvania, notably the Beaver River, and made Pennsylvania engineers Abner Lacock, Matthew R. Stealey, Alonzo Livermore, Antes Snyder, and Sylvester Welch the national authorities on the design and construction of river slackwater navigation projects.⁴¹

When James R. Skiles and the Green River Commission received \$536 from the Commonwealth for a navigation survey, they employed Pennsylvania engineers Abner Lacock and Matthew Stealey, who examined the Green River in October 1833. Rather than building a canal parallel to the river or using wingdams to improve the river's navigation, they proposed damming the river with stone-filled timbercribs to establish slackwater navigation. In design, timbercribs were large wooden boxes resembling log cabins. Placing these wooden cribs side by side across the river and filling their interiors with stone formed the dam. Lacock and Stealey warned that iron bolts should be driven through the timbercribs into the underlying rock (foundation) to fix the dams in place and that timber should be spiked atop the cribs to hold the stone in place. They recommended that the navigation locks at the dams be built of sturdy stone masonry, and they proposed that the Green River locks be 140 feet long and 36 feet wide inside their chambers. "Locks of this size would admit the passage of steam boats of sufficient tonnage to accommodate the trade of the country," they declared, "and transport to market the various productions of the extensive region embraced by the meandering of this placid and beautiful river."⁴²

With Governor Breathitt's continuing support, the legislature in 1834 provided initial funding for construction of the first two locks and dams on the Green River. Employing Pennsylvania engineers William B. Foster and Alonzo Livermore to manage the project, the Green River Commission began building the first lock and dam project in Kentucky. This work on the Green and its tributary Barren River excited navigation proponents on other rivers in the Commonwealth, notably the Licking River in northern Kentucky and the Kentucky River in the state's central sector. These pressed for the creation of an independent Board of Internal Improvement to manage a state-wide navigation and transportation system and to employ professional engineers to direct the surveys and project construction.⁴³

Lieutenant Governor James Morehead, vigorous advocate of internal improvements, became governor at Governor Breathitt's death in 1834, and he orchestrated the development of a state-wide transportation system. Much dispute arose over which projects should receive state support. Louisville newspapers urged speedy extension of the Lexington and Ohio Railroad from Frankfort to Louisville, for example, while editors of the *Frankfort Commonwealth* argued the connection to Louisville should instead be made by improving Kentucky River navigation. Railroads were not well suited to the trade, Frankfort's editors argued, and indeed the success of the Lexington and Ohio Railroad was not assured in 1834. Built at a cost of \$370,000, mostly at state expense, the first twenty-nine miles of track carried only horse-drawn carts in 1834.⁴⁴

After an experimental steam locomotive built at Lexington failed, the railroad company purchased a locomotive from the East, which Captain John

Armstrong and his steamboat *Argo* transported upriver to Frankfort at the end of 1834. The locomotive's initial operation in January 1835, however, proved disastrous. When a boy attempted to jump aboard, he missed his footing and the train crushed him. Farther down the track, a car derailed, throwing its passengers under the wheels and down the embankment, killing one passenger and mangling the rest. The superiority of railroads over canals, steamboats, and turnpike roads was not evident in 1835, and, noting it would cost \$600,000 to complete the railroad from Frankfort to Louisville, Frankfort's newspaper declared: "When the country is ready for the railroad system, it will then be time enough to adopt it."⁴⁵

Although regretting accidents and delays on the railroad along with washout of the Licking River bridge that took lives and interrupted work on the Maysville turnpike road, Governor James Morehead felt heartened by progress on the Green River slackwater project, which he considered a decisive test for lock and dam engineering on other rivers in the Commonwealth. "Traversing a most interesting portion of the state, the Kentucky river presents strong claims to attention," Morehead advised the legislature: "Would it not be advisable to organize a permanent board, with renewed powers to procure examinations to be made, of the obstructions to the navigation of the Kentucky river, and such other rivers as the Legislature may direct, by an able, experienced practical engineer?"⁴⁶

Responding to the Governor's initiative, the Frankfort newspaper pressed for the Kentucky River slackwater navigation with an economic brief: "The lands adjacent to it, are every where famed for their productiveness and beauty. Upon the immediate banks of the stream, the yet unbroken forests afford inexhaustible supplies of lumber. In the bowels of the earth, mineral treasures exist, whose value is immense." Replying to those who objected that the Kentucky's floods were so great that no dams could withstand them, the editors mentioned Eastern rivers where dams had withstood both floods and ice, and pointed out that abundant materials and labor might make lock and dam construction easier and cheaper on the Kentucky than on the Green River. Estimating that sales of water power alone at dams built on the Green and Kentucky might generate sufficient income to amortize construction costs, the editors urged the legislature to emulate other states and borrow funds to undertake the Kentucky River slackwater and other transportation projects.⁴⁷

When rains in January 1835 raised the Kentucky River to navigable depths and steamboat commerce to Frankfort resumed, the Frankfort newspaper declared: "When the river is full, there is not a man in the community who does not see of what benefit it would be to Kentucky if its navigation was always open. All that is necessary to secure this great benefit is the adoption of a wise system of internal improvement." Although contending that constructing the railroad on from Frankfort to Louisville deserved the highest priority, the *Louisville Journal* agreed the Kentucky River's navigation should be improved because a "navigable stream is a mine of silver, pouring an inexhaustible fund of wealth into the lap of a community."⁴⁸

In February 1835, the legislature responded to Governor Morehead's and public demands by authorizing the Governor to sell \$1 million worth of state bonds (internal improvement scrip) in the capital markets, thereby borrowing money for transportation projects. The legislature mandated the investment of two thirds of this sum in turnpike road companies, equally divided among the northern, central, and southern sectors of the state. It created a Board of Internal Improvement with Governor Morehead as its *ex officio* president to manage the state's transportation projects, authorizing it to employ professional engineers to perform surveys, prepare designs, and supervise construction. The legislature directed the Board to distribute \$50,000 for completion of the first two locks and

dams on the Green River project and to expend \$5,000 for the removal of fishtrap dams and natural obstructions from the Upper Kentucky River. Starting the slackwater navigation project on the Kentucky, along with navigation projects on the Licking, Cumberland, Salt, Big Sandy, and other streams was suspended until the Board had employed professional engineers to survey these rivers and plan the projects.⁴⁹

Kentucky's belated entry of 1835 into major internal improvement efforts prevented the excessive over-investment that bankrupted other states during the economic depression of 1837. On the other hand, the construction of major elements of its transportation system had scarcely begun before the depression and disruption of capital markets caused a fiscal crisis in the Commonwealth that truncated many promising projects. One of these was the slackwater system on the Kentucky River, brought to a stop after the completion of only five locks and dams on the lower river.

After fiscal collapse of the state's internal improvements program during the 1840s, Kentuckians began to ask how they had become involved in such a debacle. Jacksonian Democrats successfully pinned the blame on Whig party leadership, and this contributed to the demise of the Whig party toward the end of the 1840s. But the state's transportation system of internal improvements originated before Henry Clay's Democratic Republican party split to form the Democrat and Whig parties. The state transportation system enjoyed bipartisan support until fiscal constraints abruptly ended construction, and it became politically advantageous to lament the state's financial losses. Still, Governors Thomas Metcalfe and James Morehead and other Whigs sought to apply the principles of Henry Clay's American system at the state level, encouraging manufacturing and development of Kentucky resources together with a transportation system to market the production and thereby make the Commonwealth more self-sufficient. This provides ample reason for listing the Kentucky River's locks and dams as an enduring legacy of Kentucky's Whig party.

Kentucky River

3

THE SCIENTIFIC MAN

The dark and bloody river, upon whose banks the ignorant savage has often stood in mute amazement at its tremendous power and velocity, is made to yield in subjection its angry waves to the superior and irresistible skill of scientific man.
Orlando Brown, 1839

Plans for curbing the unruly Kentucky River and transforming it into a placid servant of Bluegrass commerce culminated in the 1830s with the application of marine and civil engineering to its waters. Frankfort's shippers merged their resources to finance the marine design of steamboats specially suited for Kentucky River's commercial and passenger service, and they built the swiftest steamboats afloat on the inland rivers. To foster this steamboat commerce, the Commonwealth hired national experts to design locks and dams capable of withstanding the Kentucky's power and holding pools of slackwater for year-round service to navigation. These expert scientific men, who styled themselves civil engineers, planned an elaborate lock and dam system for decades of service. So respected were the arcane and scientific skills of these civil engineers that Kentucky rewarded their services better than the services of its own state governor.¹

Frankfort merchant Philip Swigert and his associates sought coordinated and systematized Kentucky River commerce during the 1830s. Before 1834, the Philip Swigert, the Ward and Moffett, and the C. and J. Samuels companies supplied their Frankfort warehouses with shipments arriving aboard separate steamboats. When the Lexington and Ohio Railroad reached Frankfort in 1834, Swigert merged his business with Ward and Moffett to transship commodities from the new railroad to steamboats bound for Louisville and also opened a branch office at St. Louis. Swigert and Moffett acquired the steamboat *Plough Boy* commanded by Captain William Hubbell to export commodities from Frankfort to Louisville and St. Louis and to import merchandise from New Orleans via Louisville. The C. and J. Samuels warehouse at Frankfort shipped with Captain John Armstrong and his steamboat *Argo*. These firms stored Bluegrass commodities for export in their warehouses during autumn's low water stages, and when winter rains came near Christmastide, raising the Ohio and Kentucky rivers to navigable depths, their steamboats ascended to Frankfort to load for shipment during the annual high-water season.

The Frankfort shipping and warehouse companies merged in 1835 to form a maritime cartel. Philip Swigert, Moffett, and the Samuels at Frankfort joined with G. and A. Buchanan of Louisville to monopolize the Kentucky River's steamboat commerce. They owned both the *Argo* commanded by Captain Armstrong and the *Clinton* under Captain Samuel Clarke and operated them on coordinated schedules with one steamboat departure daily from Frankfort. This shipping cartel also entered the Louisville to New Orleans and St. Louis trades as well, building the steamboats *Rodolph* and *Empress* in 1835 and 1836.

Named for a race horse owned by Philip Swigert, the 150-ton *Rodolph* ascended to Frankfort on its maiden voyage in 1835, then entered the Louisville to New Orleans trade. When Captain Samuel Clarke and the *Rodolph* set a new record on the New Orleans to Louisville run, making the trip in six days and twenty-two hours, Frankfort newspaper editor Orlando Brown boasted: "It seems but as yesterday when this beautiful boat came up in all her pride of power to the capitol of Kentucky.... Kentuckians will back her Rodolph of the turf against the world—their

Rodolph of the waters has no rival East or West." Frankfort's steamboat combine built the *Empress* the following year, and Captain John W. Russell took it on a run surpassing the *Rodolph's* record of the previous year.²

Frankfort's steamboat commerce remained intermittent in 1835, however, regular only during the winter and spring high water stages, because ripples and shoals on the Kentucky blocked their access to the capital during the low-water stages. "When the river is full, there is not a man in the community who does not see of what benefit it would be to Kentucky if its navigation was always open," proclaimed editor Brown in 1835, concluding: "All that is necessary to secure this great benefit is the adoption of a wise system of internal improvement."³

Responding to the campaign by Orlando Brown and Governor James Morehead for the application of engineering science to the Kentucky and other rivers in the Commonwealth, the state legislature in February 1835 approved an internal improvement program of transportation projects funded largely by the state's credit. To manage this program, it created an independent Board of Internal Improvement to select which transportation projects would receive state funding and to employ engineers for project planning. This Board consisted of the Governor and three members he appointed with the consent of the Senate. Governor James Morehead in 1835 selected political leaders James Harlan, John Hickman, and Orlando Brown as the first Board members. Brown's family plantation was near Gratz on the lower Kentucky River, and he was an influential proponent of improving the river's navigation. Austin P. Cox of Frankfort became the Board's secretary, serving the Board until 1851.⁴

After the legislature adjourned, Governor Morehead organized the Board of Internal Improvement in March 1835. At its first meeting, the Board used state funds to purchase stock in Bluegrass turnpike companies and it advertised for applications to the position of state engineer. Finding no Kentucky engineers with adequate experience, the Board offered the position of Chief Engineer to Matthew R. Stealey, the Pennsylvania engineer who had planned the Green River locks and dams in 1833. When Stealey declined the offer because he was committed to completing a project in Pennsylvania, the Board hired Major R. Philip Baker of Tennessee. Baker had performed river surveys with Major Stephen H. Long of the Corps of Engineers, had designed locks and dams for the State of Alabama on a canal around Muscle Shoals on the Tennessee River, and he was building wingdams on the Tennessee River near Knoxville when he accepted Kentucky's offer.⁵

As assistant engineer, the Board selected Napoleon B. Buford, the Army officer who assisted Lieutenant William Turnbull in the 1828 and 1829 surveys of the Kentucky and Licking rivers. A Woodford County native, Buford was professor at the West Point Military Academy when he resigned from the Army to accept Kentucky's offer of a salary several fold larger than Army pay. When Buford arrived at Frankfort, the Board dispatched him to examine the Upper Kentucky River and its Three Forks and to supervise the removal of obstructions from these streams.⁶

The state legislature in early 1835 appropriated \$5,000 specifically for clearing the Upper Kentucky and its Three Forks to improve their descending navigation for flatboats loaded with coal and salt. Buford went up to the Three Forks in August 1835 and found this mountainous region nearly destitute of transportation other than boating on the rivers. He reported this region had quantities of coal, salt, mineral, and timber best "enumerated by the word inexhaustible." In 1835, coal mines on the upper river and its forks shipped 75,000 bushels of coal downriver that sold for \$9,000; salt production there amounted to about 250,000 bushels that descended the river in boats to Clays Ferry for use at Lexington and also as far as Frankfort. Other upper river commerce in 1835 included 3,000 sawlogs worth \$5,000 and 30,000 pounds of ginseng, deer skins, furs, honey, beeswax, and feathers worth \$10,000.⁷

To remove obstructions to this commerce, Buford contracted with local firms to clear snags and boulders at seventy-nine places on North Fork, from the White and Brashears saltworks at Leatherwood Creek downstream 127 miles to its juncture with South Fork. He contracted for removing an immense drift pile that had blocked the mouth of Middle Fork since deposited by the 1817 flood, and for demolishing sixty-five fishtrap dams and old mill dams from the upper Kentucky River's channel. This clearance work opened safer channels for the 50-ton coal and saltboats descending to markets on rises, or "tides," that were four feet lower than previously required for navigation of the streams.⁸

At Chief Engineer R. Philip Baker's first meeting with Governor Morehead and the Board of Internal Improvement, he mentioned that while in Tennessee he had observed that building a canal from the Tennessee to the Savannah River for waterborne shipments to the Atlantic coast seemed feasible. A Board member, probably Orlando Brown, advised Baker that a canal or railroad from the Upper Kentucky River to the Cumberland River and from thence through Cumberland Gap to the Tennessee River might also be a feasible project. The Board first assigned Baker to surveys of navigation on the Rockcastle and Cumberland rivers near the Tennessee border, and he proceeded to Barbourville for these surveys. Baker thought both streams could be cleared for descending navigation, but doubted that either would support sufficient commerce to justify building locks and dams for steamboats. While at Barbourville, he received a directive from the Board to survey potential canal routes from the Upper Kentucky to the Cumberland River and he completed cursory examination of the routes before proceeding to Port William (Carrollton) at the Kentucky River's mouth in September.⁹

Observing that the first Green River lock and dam would be completed by the end of 1835, Orlando Brown, who was monitoring Baker's progress by mail, told his readers that the state engineers were beginning their Kentucky River survey to determine whether slackwater navigation would be feasible. If locks and dams were constructed on the Kentucky, Brown predicted, "it will constitute an era in our history, and will shape our policy so as to bring into action resources which are now dormant, but whose value is incalculable." Brown reassured northern Kentuckians that the state engineers would survey the Licking River after they finished on the Kentucky.¹⁰

On September 25, 1835, Baker and Napoleon Buford began their Kentucky River survey, traveling in a keelboat upstream and using the 1828 survey maps by Turnbull and Buford as their guide. At the river's mouth, they checked the low-water marks and found the flow in September 1835 was nearly the lowest ever recorded. Checking the high water marks at the same point, they determined the difference between the low and high water marks was fifty-seven feet. Designing locks and dams to withstand floods that were fifty-seven feet deep might prove challenging.¹¹

Because no major changes in the river's regimen had occurred since 1828, Baker and Buford did not use transits to run a new line of levels to determine the river's total gradient or fall. Proceeding four miles upstream, the first ripple obstructing navigation was found at Horseshoe Bend. The river slowed rounding this bend, dropping its sediment load to form a sand and gravel bar. Here, and at the other ripples upstream, they measured the amount of fall, sounded the channel depth, and used the keelboatmen's iron-shod poles to probe through the gravel to find solid rock that might become the foundation of locks and dams. Baker explained that the Kentucky, "in common with that of most other upland rivers, exhibits at low water a continual succession of basins, or pools, of deep still water, interrupted by shoals or rapids. These basins or pools are of various lengths, from 1/4 of a mile to more than five miles, and usually deep and unobstructed, and their surfaces being held up by the bars which separate them from each other, and which produce the effect of so many

dams, the water in them is so nearly level, as to be nearly destitute of any sensible motion." Baker counted thirty-four ripples in the river below Frankfort, with the fall at each varying from six inches up to three feet. At low water, Baker reported, these shoals presented "insuperable obstacles" to navigation.¹²

When Baker and Buford reached Frankfort on October 20, a river rise stopped their survey because examining the river bottom at low-water stages was important to lock and dam site selection. Remaining in Frankfort while Buford went to Covington to start the Licking River survey, Baker wrote two survey reports, a preliminary report submitted in January to accompany Governor Morehead's annual message and a detailed report in February.¹³

Baker warned that building locks and dams on the Kentucky River would be more difficult than on the rivers in Pennsylvania where locks and dams had been completed. The Kentucky is a longer river, he observed, draining more territory, and its rocky soil and narrow valley saw sudden, extreme flooding even in summer: "The rains that fall in summer run quickly into the river, and the supply is thus wasted in a momentary flush." Plans for improving the river's navigation necessarily took into account these floods and also the sand and gravel deposits the floods dropped in the channel.¹⁴

Because many Kentuckians thought the river's low-water flow too puny to provide slackwater navigation, Baker studied this carefully and explained in detail how he computed the stream flow. First, he drove stakes on both sides of the river at a selected point, measured the distance between them, and sounded the river's depth between the stakes. Moving downriver a short distance, he drove another sets of stakes on the two riverbanks and took the same measurements. Using these measurements and the distance between the two sets of stakes, he created a mathematical prism of the river's channel roughly shaped like a half cylinder, and this allowed him to calculate the volume of the river in cubic feet. Once his calculation was done, Baker had a surveyman carrying ten apples wade into the river midway between the upper set of stakes. The surveyman released the apples one at a time, and Baker used his stopwatch to time the passage of the apples as they floated down to the second set of stakes. Baker calculated the average speed of passage of the ten apples, then applied an engineering formula compensating for flow variations between water on the surface and at the bottom. This calculation indicated a low-water discharge of nearly 20,000 cubic feet per minute (333 cfs). Repeating this test at other points along the Kentucky, all had the same approximate discharge averages.¹⁵

Baker pointed out this low water flow was larger than that of the Conemaugh River near Johnstown, Pennsylvania, where locks and dams were in service. Pennsylvania's chief engineer, Sylvester Welch, had calculated the Conemaugh's low flow at only 650 cubic feet per minute. Indeed, flow measurement on the Conemaugh, Lehigh, Beaver, and other Pennsylvania rivers showed smaller low-water discharges than the Kentucky. Baker therefore declared the Kentucky's flow sufficient, if the dams were tightly constructed, to pass a hundred boats through the locks daily with enough surplus flow remaining to operate waterwheels and millstones at the dams. Building water-powered mills alongside the navigation locks where water transportation on the Kentucky was convenient, Baker observed, could very well stimulate extensive and profitable industrial development.¹⁶

Baker addressed other public concerns about a lock and dam project on the Kentucky. Some doubted that dams could be built that would stand against the Kentucky's floods. Baker admitted that if "unskillfully contrived or faithlessly executed, they will be apt to fail," but he proclaimed it could be done. While



The Kentucky River navigation locks were built of stone masonry before 1900.

many dams in rivers had failed in earlier days, the skills and experience of engineers had so improved by 1836 that they could design and build dams for Kentucky that would stay put. These could be stone masonry, or timber-cribs dams filled with stone, and either type of dam could serve the purpose.¹⁷

Kentuckians feared that dams on the river might increase flood heights and damages and that stagnant pools above the dams might become health threats. Baker assured them that fifty-foot floods on the Kentucky would entirely inundate the dams, leaving hardly a surface ripple to mark their location. In response to the health concerns, he noted the river in its natural state was dammed at thirty-four ripples, and the pools created by the dams would be no more stagnant than the natural river; that is, the river's flow would be the same. If the dams had any effect, the deeper pools they impounded might even enhance health locally.¹⁸



Timbercrib dams were constructed by framing pens resembling log cabins, setting them side by side across the river, then filling them with stone and planking the top.

Having disposed of environmental concerns, Baker took up an engineering challenge that concerned him. Everyone in Kentucky knew the Louisville and Portland Canal and its locks filled with sediment after major floods on the Ohio; and traffic waited for weeks after each flood while workers and dredges manually excavated sediment from the locks and canal. Because the Kentucky River bore a heavy sediment load down from its mountainous tributaries, Baker admitted that sediment deposited in lock chambers by floods worried him. But he had a solution! He proposed use of his patented sediment gates at each lock. These were cast-iron valves installed under lock gates at the bottom of the lock chambers. Opened by levers attached to buoys floating in the river alongside the locks, flood rises would raise the buoys, automatically opening the cast-iron valves and releasing a current across the lock-chamber bottom to sweep out sediment. Although untested, Baker seemed certain they would serve the purpose well.¹⁹

In his opinion, the *only means* of providing permanent, year-round navigation on the Kentucky River was to construct locks and dams establishing reliable depths for steamboat commerce. On project economics, however, Baker eschewed any analysis. Noting the rich resources of the Kentucky River valley, he merely observed this "is so much better understood by the citizens of Kentucky, than in the nature of things, it can be by me, that it is left to their discussion."²⁰

Baker presented the Board with optional plans for two slackwater projects, one with a minimum six-foot depth to carry 200-ton steamboats and the other with a minimum five-foot depth for 100-ton steamboats. His five-foot slackwater plan conceived locks with in-chamber dimensions of 140 by 36 feet to handle 100-ton boats. This plan involved building five locks and dams below Frankfort, in ascending order at Horseshoe Bend, Marion, Six Mile Creek, Cedar Creek, and Essex Ripple at a cost of \$169,170.²¹

Baker's six-foot slackwater depth plan contemplated construction of four locks and dam below Frankfort: No. 1 to be located at Horseshoe Bend (River Mile 4); No. 2 at Six Mile Ripple (River Mile 31); No. 3 at Cedar Creek Ripple (River Mile 42); and No. 4 at Lee's Ripple (River Mile 65). These would have stone masonry locks, 170 by 36 feet inside the chamber, and dams constructed of stone-filled timbercribs.²²

To overcome the forty-five foot river fall from Frankfort to Carrollton, Lock and Dam No. 1 at Horseshoe Bend would have a 17-foot lift, creating a 27-mile long pool to drown 17 ripples. Lock and Dam No. 2 at Six Mile Ripple would have a 14-foot lift, establishing a 10-mile long pool covering 4 "bad" obstructions. No. 3 at Cedar Creek with a 14-foot lift would provide a 23-mile long pool inundating 14 ripples; and No. 4 at Lee's Ripple would create a 15-mile-long slackwater pool extending upstream to Gilbert's Ripple above Frankfort. At these sites, Baker thought all the locks and dams could be built on solid rock foundations except at No.1 nearest the Ohio River. Not including the costs of lockhouses and contingencies, Baker's rough cost estimate of these four locks and dams was \$185,902.²³

These dams on the Kentucky would be higher than most built earlier on other rivers, but higher dams meant that fewer dams would be constructed, thereby reducing construction costs. Baker mentioned that a dam built on the Conemaugh River was 550 feet long and 34 feet high, larger than any he planned for the Kentucky; and he quoted Pennsylvania's Lehigh River engineer Josiah White, who asserted that high dams were as just as safe as low dams if their base was as wide in proportion to their height.²⁴

Although the five-foot slackwater depth project could be constructed at less cost, Baker urged the Board of Internal Improvement to adopt the six-foot deep project. The smallest steamboats then engaged in regular trade to New Orleans registered at about 168 tons and could carry 200 tons when fully loaded. Boats of this size loaded on the Kentucky River could, if desired, proceed directly to New Orleans without transshipping cargo to larger boats at Louisville. These steamboats were 156 feet long including their sternwheel and 35.5 feet wide including the guards, with depth of hold at six feet. For boats of this class, Baker recommended that the lock chambers should be 170 feet long and 36 feet wide, allowing 14 feet clearance in length and 6 inches in width. Baker noted that a boat specially designed to fill a lock this size might transport as much as 250 tons with careful operation of the lockgates.²⁵

Baker concluded that if his slackwater project were adopted, the year-round navigation on the Kentucky River would be far better than the navigation on the Ohio River, which was suspended by low water stages each autumn. He figured the cost per mile of slackwater navigation on the Kentucky might well be less than the cost per mile of turnpike roads then under construction in the Commonwealth.²⁶

Because the flood of October 1835 had interrupted his survey at Frankfort, Baker deferred planning the locks and dams upstream of Frankfort until he had completed a survey of the upper river. As directed by the Board, however, while he was at Barbourville he had examined canal routes from the upper Kentucky to the Cumberland River, and he reported his findings at length. Although such a canal seemed at first "absurd," he found it feasible as an engineering project. The best route appeared to be up the Kentucky's South Fork to the saltworks on Goose Creek, then up Goose Creek and over the divide to Richland Creek leading into the Cumberland. From Cumberland Ford (Pineville), the canal might follow a tributary to Cumberland Gap, pass through the Gap in a tunnel to the Powell River, then down the Powell into the Tennessee River and from thence across another divide to the Savannah River and on to the Atlantic coast. Aware that the engineering profession's drift had set "in the direction of railroads," Baker reported that either a railroad or a canal along this route was entirely feasible; indeed, France and Pennsylvania had built canals along more geographically challenging routes. In proposing the Kentucky to Cumberland canal, however, Baker made a strategic career mistake—the Board of Internal Improvement in 1836 sought to employ engineers who were not wildly visionary.²⁷

Submitting Baker's reports to the legislature, Governor Morehead and the Board of Internal Improvement declared his reports clearly demonstrated that slackwater navigation was feasible on the Kentucky River. On the issue of project economics, the Board reported that the aggregate population of counties bordering the river totaled 167,269. Engaged mostly in agricultural production, this population needed better access to markets for profitable development of the river valley's "inexhaustible resources of coal, iron, salt, and lumber."²⁸

Although Baker's reports seem masterful in comparison with other engineering reports of the era, he pled poor health and left Kentucky's service in early 1836. His grandiose canal scheme and experimental sediment gate may not have endeared his services to some members of the Board of Internal Improvement. Too, his relations with Assistant Engineer Napoleon Buford had been less than cordial, and Buford had the ear of Board member Orlando Brown. Baker transferred to the Corps of Engineers as assistant to Major Stephen H. Long on the Ohio and Mississippi river projects.²⁹

William Owsley, Governor Morehead's Secretary of State, chaired the Board of Internal Improvement when it met in 1836 to replace Baker—only Buford remained on the state engineering staff, and he was assigned to the Licking River project. The legislature in 1836 authorized the Board to employ a chief engineer and five assistant engineers, providing a total of \$10,400 for their salaries, but with this sum the Board could hire no engineers it considered competent. Skilled scientific engineers then enjoyed demands for their services in many states building internal-improvement transportation projects. Requesting the legislature to increase the funding for salaries, the Board declared: "To convert our rivers, which are now, except in times of floods, of little or no use in affording an outlet to the products of the country, into channels navigable at all times, for steamboats of one hundred and fifty tons burthen, was, in the opinion of the board, a work of too great concern to the public to be committed to the charge of inexperienced men."³⁰

When the Governor appointed James R. Skiles, the Green River project promoter, to the Board of Internal Improvement, the Board sent him to Pennsylvania to hire engineers. At Pittsburgh, Skiles offered Sylvester Welch \$3,000 to become Kentucky's chief engineer, promising to raise it to \$4,000 the second year, and Welch accepted. Trained on New York's Erie Canal by Canvass White, Welch worked on the Lehigh River with Josiah White and later joined the Pennsylvania Canal project, serving as chief engineer of its western section. Under Welch's management, the Conemaugh River locks and dams had been completed, but he was more famous for designing the Allegheny Portage Railway which carried canalboats over the mountain on their way to Pittsburgh; for this project he had designed and built the first railway tunnel in the United States. From the roster of Pennsylvania engineers, Skiles also hired Matthew R. Stealey for \$2,500 annually as resident engineer in charge of the Kentucky River. Of these two, the Board reported, "Nothing is to be apprehended from their want of skill or experience, and nothing from wild and visionary experiments."³¹

The Board increased Napoleon Buford's pay as assistant to \$1,800 and employed additional assistant engineers from Pennsylvania. These were Henry Eastin, Antes Snyder, Alonzo Livermore, and George Stealey, a relative of Matthew Stealey. George assisted Matthew Stealey on the Kentucky River project; Eastin supervised the state's turnpike road projects; and Livermore replaced William Foster as the chief Green River engineer. Antes Snyder and William Foster became the Board's survey engineers, roving across the Commonwealth studying new projects. It is said that William Foster, with his engineering salary, purchased a piano for his brother, Stephen Collins Foster, who became a famous composer in Kentucky and nationally.³²

Chief Engineer Welch sent Antes Snyder up the Kentucky River to restudy the canal route proposed by Baker from the Kentucky to the Cumberland River, and Snyder learned that the Goose Creek saltworks near Manchester had increased production to 6,000 tons annually, shipping two-thirds of it down South Fork and the Kentucky River and wagoning the rest to Barbourville and on into Tennessee. Snyder reported the proposed canal from Goose Creek to the Cumberland River would be thirty-five miles long and require building enough locks to raise canalboats a total of 160 feet. He suggested that a \$5,480 appropriation be used to clear obstacles to the saltboats descending Goose Creek and the South Fork to the Kentucky River, although making navigation safe through the Narrows, the South Fork's major obstruction, would require building a lock and dam at a \$68,520 cost. The Board of Internal Improvement deferred action on Snyder's proposals, pending completion of the high priority Kentucky River slackwater navigation.³³

In the spring of 1836 the Board instructed Sylvester Welch to promptly complete designs, prepare specifications, and award contracts for a six-foot slackwater project on the Kentucky River. Welch checked Baker's survey of the river below Frankfort, while Matthew Stealey resumed the survey where Baker's stopped at Frankfort and examined the river upstream to the Three Forks. Finding the gradient calculations for the lower river accurate, Welch concurred with Baker's site selections: Lock and Dam No. 1 should be located at Horseshoe Bend, No. 2 at Six Mile Creek, No. 3 at Cedar Creek, and No. 4 at Lee's Ripple. Above Frankfort, Welch chose Steele's Ripple as site of Lock and Dam No. 5. Located 17 miles upstream of No. 4 and 82 miles above the river's mouth, No. 5 could extend six-foot of slackwater as far upstream as Warwick and Oregon landings, 95 miles above Carrollton, and provide a lesser depth even to Munday's Landing at Mile 109.³⁴

Welch and Stealey concurred with Baker's recommendation that the Kentucky River slackwater have a minimum six-foot depth, channel width of 350 feet, and locks large enough to handle the medium-size 150-ton steamboats that commonly carried the Ohio River trade upstream of Louisville. Welch's analysis indicated the Kentucky River trade would eventually be carried both by steamboat packets and by small steam towboats pushing barges. "Merchandise and a considerable portion of the agricultural produce will be conveyed in steamboats," Welch predicted, while "coal, iron, staves and such other lumber, as is not transported in rafts, will be conveyed in towboats." Because towboats, or small steamboats pushing wooden barges, then were novelties on the inland rivers, Welch elaborated: "In conveying coal from the mines to market, two coal boats carrying at least 150 tons each, would be towed upon the slackwater by a small steamboat at the rate of 5 or 6 miles per hour."³⁵

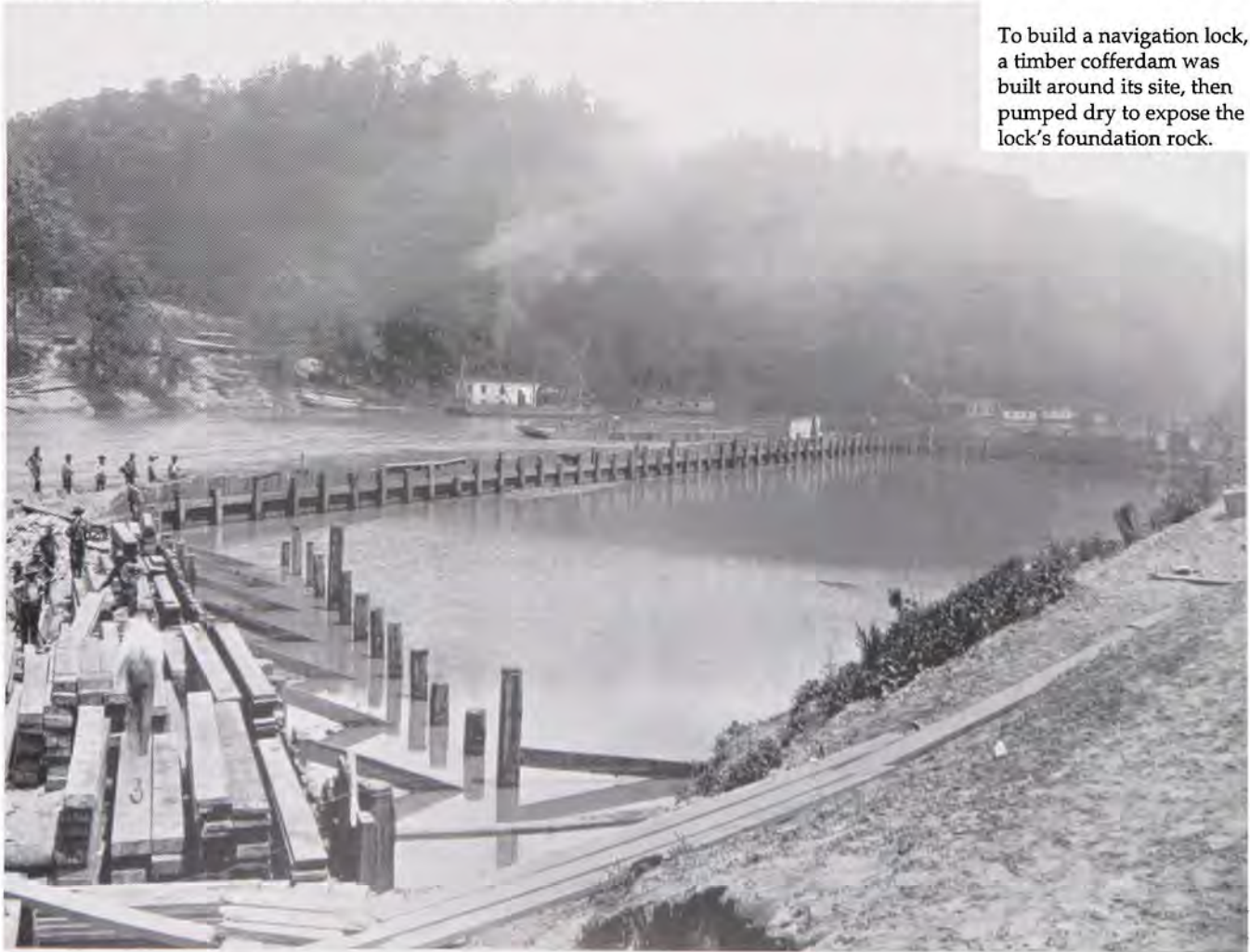
To serve this predicted commerce, Welch and Stealey somewhat enlarged the lock chamber dimensions proposed by Baker. Baker had contemplated 170 by 36 feet lock chambers for boats that were 156 feet long by 35.5 feet wide; the extra length leaving room for opening the lower lockgates inside the chamber. Welch and Stealey increased the lock length to 175 feet and width to 38 feet, providing additional space for locking a barge and small towboat simultaneously. Including lockhouses and stables for use of the lock keepers and seven percent for contingencies, Welch and Stealey estimated the total cost of the five locks and dams at \$701,405, much higher and closer to reality than Baker's \$186,000 estimate. Baker's estimate, however, included only four of the five locks and dams and omitted the lockhouses and contingencies. Even the Welch and Stealey estimate in the end proved forty percent too low, but perhaps it might have been accurate if the work had been accomplished by 1838 as the engineers initially planned.³⁶



The Wernwag covered bridge completed in 1838 at Hickman or Camp Nelson.

During May and June 1836, Matthew Stealey and his assistant George Stealey prepared specifications and drawings for the bid packages to be given contractors for building Locks and Dams Nos. 1 through 5. The total outside length of the lockwall stonemasonry would be 236 feet with the walls being as wide and thick as the resident engineer deemed necessary "for the security of the lock." Plans called for the contractors to build a cofferdam around the lock site, pump out the water, then dig a 244-foot long, 76-foot wide pit down to rock foundation, leveling the rock surface before placing stone masonry and the timbers lining the bottom of the lock. The stone masonry was to be regular dressed stone grouted with hydraulic lime mortar furnished by the Board of Internal Improvement. Lockgates were to be white oak framing seasoned at least a year and planked over with yellow pine. Three cast-iron paddle gates in each lockgate would fill and empty the lock chamber, and a cast-iron rack and pinion gear connected to a capstan would open and close the lockgates. While the Stealeys did not adopt Baker's patented sediment gate, they included "flood gates" designed by Welch to open a sluice beneath the lockgates that could release a current to wash sediment from the lock chambers.³⁷

The Board of Internal Improvement advertised and received a large number of competitive bids for the work from contractors who had worked on the Pennsylvania and Alabama canals and on the Green River project underway in western Kentucky. All the bids proved higher than the Welch and Stealey cost estimates, however, except for Lock and Dam No. 3's construction. Taken aback by the high bids, the Board refused to award contracts for any amounts exceeding its engineers' estimates, while the low bidder for building No. 3 refused to sign a contract for less than the engineers' estimate. As an alternative, the Board offered to award the contracts for building all five structures at the prices its engineers had estimated, and



To build a navigation lock, a timber cofferdam was built around its site, then pumped dry to expose the lock's foundation rock.

No. 1. ---Bids for the construction of Locks and Dams on the Kentucky River.

NAMES OF BIDDERS.	LOCK AND DAM.					Average bid.	Lowest bid.	Price at which the Pks were let.
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.			
Joseph Barbour & Co. - - -	151,055							
Matthews & Wilson, - - -	211,185	-	-	-	-	203,862	151,955	138,793
Guion & Johnson, - - -	248,448							
Joseph Barbour & Co. - - -		117,980						
Raush & Ferguson, - - -		107,527	-	-	-	119,754	107,527	114,582
T. & A. Darling, - - -		121,088						
Wilson & Matthews, - - -		133,519						
Joseph Barbour & Co. - - -			112,630					
Guion & Johnson, - - -			189,025					
Raush & Ferguson, - - -			117,471	-	-	135,683	112,630	110,999
T. & A. Darling, - - -			127,565					
Matthews & Wilson, - - -			131,767					
Joseph Barbour & Co. - - -				111,680				
Raush & Ferguson, - - -				111,835				
T. & A. Darling, - - -				122,191	-	119,679	111,680	109,109
Matthews & Wilson, - - -				133,011				
Joseph Barbour & Co. - - -					125,355			
Matthews & Wilson, - - -					144,485	141,232	125,355	118,470
Lyon & Co., - - -					153,858			
NOTE. ---It is proper to remark, that \$1,627.00 in work was added to each lock, after the bidding --- altogether amounting to the sum of,						720,210	609,147	591,959
								8,138
								583,821

List of bids received in 1836 for constructing Locks and Dams Nos. 1 through 5 on the Kentucky.

some of the contractors accepted this offer. Later, the Board took credit for negotiating the contracts for a total of \$27,288 less than the aggregate total of the contractors' low bids on the jobs.³⁸

On the Fourth of July 1836, William Owsley and the Board awarded the contracts for building Locks and Dams Nos. 1 through 5 for a total of \$591,959. Under the contract terms, the Board would furnish hydraulic lime mortar for the lock masonry, make separate contracts for building lockhouses and clearing the slackwater pools of trees and snags, which together with contingencies brought the estimated project costs to \$701,405. The contractors agreed to complete all five locks and dams in thirty months of construction, by November 1, 1838. "The fourth of July, memorable as it already is," proclaimed Orlando Brown in the *Frankfort Commonwealth*, "will hereafter possess additional interest to Kentucky as being signalized by the commencement of an improvement which will do honor to her legislation and to her public spirit."³⁹

The Joseph Barbour Company, which had worked at building Green River Lock and Dam 1, took the contract for building Kentucky River Lock and Dam No. 1 at Horseshoe Bend. Rauch and Ferguson took the contract for Lock and Dam No. 2 at Six Mile Creek; Thomas and Adam Darling would build No. 3 at Cedar Creek; and Matthews and Wilson would build both Nos. 4 and 5 at Lees and Steeles Ripples. Opening stone quarries, building access roads to the sites, and purchasing timber for the dams and lockgates became the contractors' first tasks. Joseph Barbour got his stone from quarries across the Ohio River near Madison, Indiana, and boated it to Lock No. 1. The Lock No. 2 stone came from a mile downstream of the lock; Lock No. 3's stone came from a cliff two miles below the lock; and Lock No. 4's stone was hauled two miles from a quarry up Benson Creek. The Lock No. 5 stone came from Stony Creek a half mile upstream of the lock at a quarry that also furnished the stone for the Old Capitol Building in Frankfort.⁴⁰

Needing hydraulic lime mortar, which hardened underwater, for the locks, the Board asked for bids from the Louisville cement plants. Upset when the lowest bid was \$2.25 a barrel, the Board sent George Stealey to search along the Kentucky River for suitable limestone to make mortar. Finding a promising rock stratum near Irvine, Stealey burned and ground a sample and immersed it in water for testing. Thinking its quality adequate, he recommended that the Board build a mortar-manufacturing plant where the Red River enters the Kentucky. The Board instead purchased its own cement plant at Louisville for \$3,500 and employed John Hulme to manage the plant. It produced 100 barrels of mortar daily at a cost of \$1.50 per barrel, and the Board contracted with Philip Swigert to deliver 3,000 barrels of mortar at sixty-two cents a barrel to each of the five lock sites. Swigert had it delivered aboard the steamboat *New Argo*.⁴¹

Wilson Knott headed the Matthews and Wilson contract work at Locks and Dams Nos. 4 and 5. He mobilized quickly and made steady progress, delivering 800 perches of stone to Lock No. 5 and 130 perches to Lock No. 4 by the end of 1836. Although the other contractors mobilized at a slower pace, their delays did not trouble the Board of Internal Improvement, which explained that the work was to be done in a superior manner to insure its durability: "Its usefulness was not expected to pass away with the present generation, and is to be constructed to last for the benefit of posterity."⁴²

The Board assigned Matthew Stealey to supervision and inspection of the contractors on the lower Kentucky and sent Chief Engineer Sylvester Welch upriver to select the sites for the locks and dams upstream of No. 5. After his survey, Welch proposed construction of 12 locks and dams, numbered 6 through 17, for the upriver project. He estimated the cost of these twelve locks and dams at \$1,596,011, which together with the five on the lower river, would make a \$2,297,416 total project cost for providing slackwater navigation from Carrollton to the Three Forks. With this report in hand, the Board requested the state legislature to provide this sum so it could place all locks and dams upstream of Lock 5 under contract in early 1837; after a two-year construction period, the entire system could open to the Three Forks by the end of 1839. "Unless accomplished to the extent indicated, the policy of the improvement would be very questionable," the Board warned, adding prophetically: "If stopped at any intermediate point, the advantages to be derived from the improvement, will of course, be diminished, and might not equal the expense of its construction."⁴³



Families pose at the Lock No. 6 stone yard in 1891.



Workers building Lock No. 6, standing on the masonry emptying culverts.

After identifying the lock sites from Frankfort up to the Three Forks, Sylvester Welch also examined the North and South Forks, seeing coalboats descending from fourteen mines along the North Fork and saltboats descending the South Fork from Goose Creek. He declared that the coal mined on North Fork was harder and contained less sulfur than the coal from Pittsburgh. Though he saw plentiful iron ore, only one furnace and forge then was in operation. Illness prevented completing a detailed survey, but he thought slackwater navigation could be provided on North Fork as far up as Hazard and on the South Fork to the Goose Creek saltworks. Welch admitted that slackwater on the Three Forks would be expensive, but he knew of several railroads that cost much more per mile.⁴⁴

After Welch and Napoleon Buford examined the lower 205 miles of the Licking River up to West Liberty, they prepared plans and specifications for locks and dams on that river in Northern Kentucky. The Board of Internal Improvement delayed entering into contracts for construction of the Licking River locks, however, because it encountered unexpected fiscal constraints. Authorized to borrow as much as \$2 million for internal improvements, the Governor in 1836 could sell only \$350,000 worth of internal improvement bonds to state banks. This same year, the Board subscribed \$200,000 to the Lexington and Ohio Railroad, \$50,000 to the Green River Railroad at Bowling Green, and \$265,392 to turnpike road companies, and meeting payments on these stocks consumed most of the funds available to the Board. It asked the Governor to sell another \$500,000 worth of bonds to cover payments to the Kentucky River contractors, but when Kentucky's agent in New York sought to market the state bonds, he found no buyers. By state law, the agent could offer no more than five percent interest on Kentucky's bonds, while Ohio's and Indiana's agents offered six percent or more. To keep work underway on the Kentucky River, therefore, the Board had to borrow \$100,000 from banks. Of this, by the time the state legislature met in December 1836, the Board had left only \$1,315; and it warned the legislators that unless they appropriated more funding forthwith, work on the Kentucky River project would cease.⁴⁵

This demand disturbed the legislators, who appointed a House committee to audit the Board's accounts. Interrogating Chief Engineer Welch, the committee learned that to continue the transportation projects in 1837 the Board would need \$273,500 for the Kentucky River slackwater navigation, \$290,500 to start construction of the Licking River locks and dams, and \$90,000 to finish the Green River locks and dams. Adding to these amounts the Board's commitments to railroad and turnpike companies, a \$1 million appropriation was absolutely essential for the 1837 construction season.⁴⁶

"It would be useless to attempt to conceal the fact that there now exists in some minds discontent with the manner in which the system has been thus far conducted," the House committee understated. Fierce criticism had arisen of the high salaries paid to the engineers, which in Welch's case was higher than the Governor's. But the committee warned that if salaries were slashed, the engineers would depart for lucrative positions in other states. Neither money nor zeal, the committee warned, could complete the projects without efficient and experienced engineers, and those already employed by Kentucky had become identified with their projects and "their reputations are staked on their success."⁴⁷

Because it appeared that engineering science was to become Kentucky's cornucopia, Thornton Johnson, a West Point graduate and president of Georgetown College, established Kentucky's first civil engineering school in 1835. He formed Bacon College, named for scientist Francis Bacon, and promised good-paying jobs for its engineering graduates. The College soon had more than a hundred students, and when it graduated its first class in 1836 Sylvester Welch employed four graduates on the state's projects, and Thomas Purcell, the Lexington and Ohio Railroad's chief engineer, hired others. Sylvester Welch found Bacon's graduates well trained in engineering science, but urged the College to provide added training in geology, chemistry, and architectural drawing combined with the principles of construction. The future seemed bright indeed for the engineering profession and for its scientific achievements on behalf of the Commonwealth's internal improvement ventures.⁴⁸

When Secretary of State Chilton Allan and Board members James R. Skiles, Archibald Wood, and Manilus Thomson met in April 1837, they confronted an emergency. The Commonwealth's bonds had found no market, and because a financial panic gripped the nation in 1837 the banks would not loan the Board any money. The Board had \$1.9 million dollars worth of road and river projects under contract, yet had no wherewithal to pay its contractors. During the economic panic, as labor and materials prices skyrocketed, the Kentucky River contractors stopped their work to await price reductions. Short of funds, the Board made no effort at encouraging them to resume construction.⁴⁹

Financial relief came from an unexpected source. President Andrew Jackson had balanced the federal budget, accumulating a substantial surplus, and Congress decided to return this surplus to state governments for public works and schools. Receiving Kentucky's share of this largess, the state's sinking-fund commission gave the Board of Internal Improvement \$850,000 to pay its contractors. In June 1837, the Board instructed its Kentucky River contractors to resume work, and, as labor and materials prices declined later in the year, the contractors began laying the masonry for Locks Nos. 2, 3, 4, and 5. Contractor Joseph Barbour would have done the same at Lock No. 1, but Ohio River floods twice overtopped his cofferdam around the lockpit. In consideration of these delays, Chief Engineer Welch persuaded the Board to grant its contractors a one-year time extension, deferring their contract completion date to the end of 1839.⁵⁰

As required by the legislature in 1837, the Board also assumed charge of the Green River locks and dams project. It decided, however, to let the Green River Commissioners continue to manage the project locally under regular inspection by Chief Engineer Sylvester Welch. The legislature required also that the Board award the contracts for constructing five locks and dams on the Licking River in 1837, but when the Board opened the bids in May it deemed them too high. When it requested new bids in October, it received acceptable prices and, moreover, persuaded the contractors to accept state internal improvement bonds in lieu of cash payments.⁵¹

Cheered by this progress, the Board of Internal Improvement announced that its transportation projects, even before their completion, had resulted in quadrupling the value of real estate adjacent to the projects. "The day is at hand when our mountains will be covered with a thriving and industrious population, preparing for market the treasures of the mines and the forest," the Board forecast: "The water power, which will be created, by the dams on our rivers, will invite to our State artisans so numerous, and will cause the establishment of manufactures so extensive, that we shall find... more than equivalents for all our expenditures. The modern improvements, in highways and steam power, are annihilating space and bringing the States together." Scientific men styled civil engineers would forever alter the Commonwealth's commercial and industrial environment.⁵²

Kentucky River

4

A VALENTINE TO THE LEGISLATURE

The projectors of the Internal Improvements of Kentucky: they will receive the thanks of a grateful people as a reward for their foresight, and wealth as a reward for their industry and perseverance.

Sylvester Welch, 1838

By 1838 severe funding shortages afflicted the Board of Internal Improvement's efforts to complete the Commonwealth's transportation network. Federal funding assistance saved its program in 1838, but in 1839 the Board had to borrow large sums to keep construction underway. To appease growing opposition to its program in the legislature, the Board ordered its engineers to accelerate construction of the Kentucky River locks and dams, opening them by December 1839 and thereby allowing legislators to travel aboard steamboats to Frankfort for their annual session. When labor shortages and flooding prevented the Board's engineers from meeting the December deadline, they rigged the locks with temporary operating gear to open them for navigation by Valentine's Day of 1840.

Chartering a steamboat, the Board took the Governor and legislators to see the new locks, suitably impressing them with the project's merits and perhaps influencing votes on appropriations before the legislative session ended in March 1840. Although this effort succeeded, much remained to be accomplished after Locks Nos. 2, 3, and 4 passed their first steamboat as a Valentine gift to the state legislature.

* * *

Surplus federal funds and the Commonwealth's Sinking Fund saved the Kentucky River slackwater and other state transportation projects from fiscal disaster in 1838. In quarterly payments, Kentucky received federal surplus revenue funds totaling \$1.4 million in 1837 and 1838, and the legislature decided to invest these funds and use the interest on the principal to finance public schools, once it had established a public school system. Because John Tilford, commissioner of the state sinking fund, found Kentucky's banks unwilling to comply with the restrictions on federal fund deposits, he invested \$850,000 of the federal funds in the state's internal improvement bonds at five percent.¹

John Tilford and former governor James Morehead went east in 1837 to sell more of the Commonwealth's bonds for internal improvements. Limited by law to offering five percent interest on the bonds, Morehead found that capitalists naturally preferred the six percent bonds offered by other states. Tilford went on to Washington, DC, however, and persuaded the U.S. War Department to purchase Kentucky's five-percent bonds. The Department agreed to invest in \$415,000 worth of the bonds, but it had purchased only \$165,000 of the bonds before policy changed and its investments ceased.²

In April 1838, when former Governor James Morehead replaced Chilton Allan as president of the Board of Internal Improvement, the funding available to the Board had dwindled to \$23,688. To obtain funds for the 1838 construction season, Morehead borrowed another \$200,000 from Kentucky banks to keep the contractors happy and busy. Construction of river projects then was done only

during the low-water stages of summer and autumn because high-water flooded the low cofferdams built around the lock and dam sites to hold out the water while work proceeded. A drought in late 1838 caused extended low water on the Kentucky River and made that year an excellent construction season. During late autumn, the Frankfort newspaper reported, the river was so low that only canoes "well steered and lightly laden could get out with a lucky run."³

Meeting its competition in the bond market, the Kentucky legislature in early 1838 approved raising the interest offered on state bonds to six percent, and in May the Secretary of State, J. M. Bullock, found an insurance company willing to invest \$1,250,000 in Kentucky's internal improvements. Proceeds from this sale did not become available to the Board of Internal Improvement until late in the year, however, after the construction season had begun, and James Morehead and the Board during 1838 had not pressed the Kentucky River contractors for swift construction. "Masons and other mechanics employed upon the locks and dams, and upon other works, come mostly from Pennsylvania and from the states East and North of that, where they have been employed upon works of Internal Improvement, and upon which they have acquired the skill that renders them useful here," James Morehead explained, and the Kentucky River contractors did not hire enough of them in 1838 to finish the stone masonry lockwalls.⁴



Finished stone was placed in the navigation lock walls

Resident engineer Matthew Stealey reported that during 1838 the contractors at Locks Nos. 1, 2, and 3 began building the lockwalls, but the masonry was only ten to eleven feet high at year's end. Wilson Knott, the contractor for Locks Nos. 4 and 5, had made better progress, raising No. 4's lockwall masonry to twenty-one feet and No. 5's to fourteen feet. The contractors had begun excavating pits to install the dam abutments in the river banks opposite the locks, but they had not begun building the dams. With "extraordinary exertions," Stealey speculated, Locks and Dams Nos. 2, 3, and 4 might possibly be completed in 1839 and Nos. 1 and 5 perhaps in 1840.⁵

In the meantime, the legislature sought to further encourage salt manufacturing and commerce in the Upper Kentucky valley. It appropriated another \$6,000 in 1838 to clear obstructions from the South Fork and Goose Creek channels that carried saltboats from Manchester to the Kentucky's main stream and on to Lexington and Frankfort. Chief Engineer Sylvester Welch assigned management of this job to Antes Snyder, who contracted for the work. James Garrard and Dougherty White, owners of Goose Creek salt works, employed workers to remove obstructive rocks, fishtrap dams, and snags from the channels. At the Narrows, the rapids obstructing South Fork's navigation, they blasted a channel through the rocks and built a stone wingdam to concentrate flow through the channel. Because this work enabled 50-ton saltboats to descend the stream in greater safety, the salt manufacturers urged the legislature to fund locks and dams on South Fork, fostering regular delivery of salt to downstream markets.⁶

Although experiencing severe funding constraints, the Board of Internal Improvement had not lost hope for extending the Kentucky River slackwater upstream to transport salt and coal from the Three Forks and it sent George Stealey to that area to investigate its resources. Compared with Pennsylvania mining, Stealey thought Kentucky's coal mining "injurious and slovenly" because it consisted of shallow drift mines frequently blocked by falling rocks. Although he saw rich iron ore deposits, only the Red River furnace in Estill County, eight miles from the Kentucky River, was then in production. The iron castings produced on Red River could get to the Louisville market only when the Kentucky River reached boating stages, meaning about once a year.⁷

The Board estimated that coal from the Three Forks transported by steamboats and barges on a slackwater system could be delivered to Louisville for ten cents a bushel, a cost competitive with coal descending the Ohio from Pennsylvania. Calculating that Kentucky coal shippers annually could sell 40,000 tons of coal at Louisville, 10,000 tons at Lexington, 4,000 tons at Frankfort, 10,000 tons at Carrollton as fuel for steamboats, and 20,000 tons at other ports, at a dollar per ton in tolls the Board thought the Kentucky slackwater could collect \$84,000 a year alone on coal shipments. Adding the tolls collected from other river commerce, the Board estimated it would have a \$154,000 annual toll revenue on the Kentucky. Also estimating that water power leases for mills built at the Kentucky River dams, if completed to Three Forks, might amount to as much as \$42,400 yearly, the Board predicted a total annual income of \$196,500 from the Kentucky River project. This seemed encouraging.⁸



Plans for the Kentucky River project included navigation locks of stone masonry and dams built of timber cribs filled with stone.

Further encouragement for the Commonwealth's slackwater projects came in 1838 when Green River Lock and Dam No. 2, the first completed in Kentucky, began operation. It passed two steamboats and fifty-two loaded flatboats in its first month of service, and Lock No. 3 opened to traffic later in the year. Slackwater project advocates argued the successful operation of the Green River locks proved that state engineers could design and build locks and dams that could withstand flood torrents and not be blocked by sediment deposits in the lock chambers. By 1838, other states had begun slackwater navigation projects with stone masonry locks and timbercrib dams similar to those being built in Kentucky. Pennsylvanians initiated a project

to slackwater the Monongahela River from Pittsburgh to Brownsville; Ohioans started a project on the Muskingum River from Marietta to Zanesville; and Indiana laid plans for locks and dams on the Wabash River.⁹

At the end of 1838, James Morehead and the Board of Internal Improvement predicted that all locks and dams abuilding on both the Green and Kentucky rivers might be completed during 1839, except where Ohio River flooding interrupted the construction of Locks and Dams Nos. 1 on both rivers. This glowing forecast so encouraged the state legislature that it ordered the Board to contract in 1839 for the construction of Locks and Dams Nos. 6, 7, and 8 on the Kentucky and a smaller lock and dam at the South Fork's Narrows.¹⁰

Complying with this legislative directive, Chief Engineer Welch in March 1839 advertised that he would take bids during the spring at Manchester for building a lock and dam at the South Fork's Narrows, at Harrodsburg for constructing Locks and Dams Nos. 6, 7, and 8 on the Kentucky, at Bowling Green for four locks and dams on the Green River and its tributaries, Barren and Mud rivers, and at Claysville for three more locks and dams on the Licking River. At Harrodsburg on May 5, the Board awarded contracts for the construction of Kentucky River Locks and Dams Nos. 6, 7, and 8, for a total of \$405,881; but it made these contracts conditional, however, on sufficient funding becoming available.¹¹

To formally accept bids for building a lock and dam on the South Fork, James Morehead and the Board traveled to Manchester where they were royally entertained at dinner by more than a hundred celebrating Clay countians. At this ceremony, Morehead predicted the project would engender an immense trade in the "salt, iron, coal, and lumber, which lay in inexhaustible quantities in the mountain region of Kentucky." In response, Sydney Williams of Manchester hoisted a toast: "The Narrows—Its dashing waves and jutting rocks, have often thrown terror and dismay over the hearts of the most skillful and daring boatmen. We trust that our scientific Sylvester Welch will have a slackwater bridle put on her at the Mouth of Tedious [Creek], which will enable us to ride smoothly over her rugged bed without the alarm word of, *Heavy down Boys*." On May 28, the Board contracted with Phio Ingerson to build the South Fork dam and its little 120 by 20 foot lock for \$53,000. Again, this contract specified that construction would not begin until funding became available.¹²

When Governor Charles Wickliffe sent the Secretary of State east in early 1839 to sell the state's bonds at six percent, there were no buyers. Nor, this time, was the state's transportation system funds augmented by more federal surplus revenue contributions. "There has been no demand for State stocks the past season," lamented Governor Wickliffe, "either in the market of the United States or of Europe." Although the Board of Internal Improvement had promised that Kentucky River Locks Nos. 2, 3, and 4 would open to traffic by the end of 1839, it again lacked the funds to pay its contractors. In this crisis, James Morehead returned to Kentucky's banks and borrowed large sums at six percent, and the Board instituted measures to assure scheduled completion of its projects. Concentrating its available funding on Kentucky and Green River construction, the Board on August 9 suspended work on channel improvements underway on Bayou du Chein and the Upper Cumberland, Little, Tradewater, and Mud rivers. Because the Licking River locks and dams were behind schedule and could not be completed for several years, the Board suspended most of the work there, transferring construction funding to the Kentucky and Green River projects. These measures cost the Board support for their program from legislators representing the areas served by the suspended projects.¹³

The legislature again appointed a committee to review the Board of Internal Improvement's crisis and appointed George W. Johnson, a legislator who later became Confederate Governor of Kentucky, as its chairman. Lamenting the number of engineers employed at high salaries by the Board, Johnson declared "the day cannot be far distant when the science of Civil Engineering will be stripped of the mystery in which it is now shrouded, and men will be astonished at the fact that *road makers* and *lock builders* should have received more than the Governors of our State and the Judges of our highest judicial tribunals." Because most of the state's surveys, plans, and contract specifications had been completed, he urged that all the engineers except the Chief Engineer and the Green River Engineer be laid off. Indeed, he proposed that the Commonwealth replace its four-member Board with a single Commissioner of Internal Improvement.¹⁴

In Johnson's opinion the state's turnpike road projects had failed miserably. After investing \$2 million in building 467 miles of turnpike roads, of the \$92,641 tolls collected on those roads in 1839 the state had received but \$7,576, a return of merely a third of one percent on the state's investment. The remaining toll revenue had gone for repairs and paying toll-gate keepers and turnpike company officials. Radical reform seemed in order.¹⁵

Johnson feared the rosy forecasts of revenue from the state's slackwater projects would also prove disappointing. He recommended completing the locks and dams under construction and testing their revenue-production capability before building more. While the Commonwealth improved its rivers and roads, Johnson warned that care should be taken, else the projects might be remembered only as "the Mausoleums which have entombed the fortunes of our contractors whom we had failed to pay."¹⁶

Recognizing the merits of Johnson's recommendations, and needing to cut costs, the Board downsized its engineering staff, laying off four and hiring one, a net reduction of three. This left it with six engineers: Chief Engineer Welch and resident engineers Matthew Stealey, Alonzo Livermore, Napoleon Buford, Henry Eastin, and William R. McKee. The new engineer, McKee, was the son of a Kentucky Congressman and had learned engineering at West Point, then left the Army to practice his profession at Lexington. The Board hired McKee because the state legislature had ordered far too many road surveys for Henry Eastin alone to handle. Welch sent McKee to survey a turnpike road from Russellville to Hopkinsville (now US Highway 68) that was built with funds transferred from the defunct Green River Railroad project.¹⁷

Several former state engineers remained on the payroll, however, as construction superintendents. Superintendent George Stealey had charge of Kentucky River construction, Jairius Livermore of the Green River, and John Bush of the Licking River. The construction superintendents or inspectors on the Kentucky River were George Stealey at Lock and Dam No. 1, James S. Evans at No. 2, Thomas McLaughlin at No. 3, S. H. Moon at No. 4, and Matthew Skelton at No. 5. These were paid only \$60 a month, a substantial reduction from their salaries as engineers.¹⁸

The Board shared Johnson's concerns about the turnpike road projects. More than half the Board's funds had gone to turnpike companies at little profit. In six years, the turnpike companies paid only \$29,100 on the state's \$2 million investment in them, and many companies neglected even to submit annual fiscal reports to the Board. The Board's influence on turnpike operations consisted chiefly of voting the state's stock in the companies by proxy. Thinking appointment of state superintendents for turnpike management might improve turnpike operations and revenues, the Board directed Sylvester Welch to superintend the Frankfort,

Lexington, and Versailles turnpike as an experiment. In his first three months on the job, Welch generated an \$800 revenue from a road that previously paid nothing to the state. The Board thought appointing state superintendents for turnpikes might generate as much as \$70,000 additional yearly revenue, but the legislature ignored its recommendation.¹⁹

Although Governor Charles Wickliffe's effort to sell state bonds failed in early 1839, at its March meeting, the Board determined Kentucky's Locks and Dams Nos. 2, 3, and 4 must be opened by year's end to demonstrate their value to the legislature, and it ordered Welch and Stealey to take all measures necessary to accelerate the work. To fund this effort, Governor Wickliffe and James Morehead attempted to sell \$200,000 worth of state bonds directly to Kentuckians. They presided personally at bond sale rallies in Louisville and Lexington with but meager results. Individual Kentuckians bought \$11,000 worth of bonds; the state's Board of Education purchased \$43,500 in bonds; and the state's contractors took another \$18,000. This \$72,500 total in sales was inadequate, and Morehead therefore borrowed another \$445,000 from banks to accelerate construction.²⁰

The Board's operations on borrowed money, its bonded mortgage on the future, and its failure to finish the transportation projects became issues in Kentucky's 1839 gubernatorial race. Charles Wickliffe did not run for reelection, so the Whigs nominated Robert Letcher. Jacksonian Democrats nominated Richard French, who vociferously blamed the Whigs for the internal improvement policies and the resulting credit crises. Whigs responded that the internal improvements initially had support from prominent Democrats, and Governor Wickliffe proclaimed that an early opening of the locks and dams below Frankfort would remove the "all doubts and difficulties."²¹

Noting that contractors on the Kentucky lacked the workforce necessary to finish Locks and Dams Nos. 2, 3, and 4 by December 1839, Matthew Stealey advertised for workers in every city on the Ohio from Pittsburgh to Louisville. When Stealey reported that the workforce continued insufficient, he found the Board of Internal Improvement "extremely solicitous" for timely completion, and it told him to dispatch agents to recruit laborers in those cities and pay their travel expenses to Frankfort. Stealey offered laborers \$22 a month plus comfortable subsistence at the contractors' expense, giving the contractors the option of either cooperating or having their contracts forfeited. This generous pay offer brought new workers, but the contractors "were taken sick." The Board then ordered Stealey to supersede the contractors at the dams with construction superintendents, essentially converting the construction from a contract to a hired-labor project directly managed by the state through Stealey.²²

When illness afflicted the workers wading in the river mud to build the dams in September, many left for drier work, preventing the completion of the Kentucky's locks and dams by December 1839 as mandated by the Board. In the meantime, project costs so escalated that Stealey revised his cost estimate upwards to \$801,396. In addition to construction acceleration, Stealey attributed the cost overrun to removing sliding riverbanks, increasing the lockwall dimensions to resist the sliding bank pressures, excavating dam abutments farther into the riverbanks to prevent flanking, and building much larger dams at Locks Nos. 1 and 2 than planned in 1836. Excavations at the No. 1 and 2 dam sites revealed that solid rock was too deep to reach, and the dams had to be built atop river gravel. To handle

this, Stealey revised earlier plans, increasing the dams' base width from sixty-six feet to eighty feet and flattening their slope to 4 on 1, thereby nearly doubling the size of the dams. In addition, Stealey obtained machines capable of dropping 1800-pound weights atop timber piling, driving it through the dams and at least ten feet into the gravel beneath them. These pile drivers also drove overlapping planks along the upstream faces of the dams to cut off flow beneath the structures.²³

While directing extensive excavations at the dams, Stealey was surprised to find items of interest to paleontologists. In nearly all the excavations at depths of fifty feet he found the "detached teeth and bones of the mammoth" in an excellent state of preservation. Retrieving these remains, he delivered them to the Board of Internal Improvement, which displayed them for public education in the Board's Frankfort office.²⁴

Because there seemed no chance of completing Lock and Dam No. 1 nearest the river's mouth by December 1839, Stealey stopped work there and sent the workers to the upstream dams; at the time, Lock No. 1's masonry was ninety percent complete, but the dam was not begun. Because Lock and Dam No. 5 upstream of Frankfort would not help to get ascending steamboats to the state capital, Stealey suspended work there also with half the lock masonry in place and the dam and abutment partly finished. This permitted him to concentrate all available workforce and materials on completing Locks and Dams Nos. 2, 3, and 4 so these could pass steamboats upriver to Frankfort. The state legislature then began its annual session in December, and arriving at Frankfort in comfortable steamboat accommodations, instead of jouncing in by stagecoach, might impress legislators with the Kentucky River's slackwater navigation benefits.²⁵

Stealey and his construction superintendents, often under the eye of Chief Engineer Welch personally, rushed the construction of Locks and Dams Nos. 2, 3, and 4 throughout the summer and autumn of 1839. At a cost of \$18,000, Stealey employed lumberjacks with crosscut saws and axes to fell trees along the riverbanks from Lock 2 upstream to Lock 5, clearing the future navigation pools of snags. They left the trees on the riverbanks to be carried away by floods. Yet, when the December deadline set by the Board arrived, and the legislators traveled to Frankfort, the locks and dams were not ready for operation. The Board directed Stealey to continue work into the winter, exposing the workers to frostbite. To float timber for construction downriver to the dams, it became necessary for the workers to chop ice to open channels.²⁶

As Welch, Stealey, and the Board of Internal Improvement hastened the locks and dams toward completion, they escorted every visitor to Frankfort to river-side to see the magnificent project abuilding. A touring British ambassador admiring Lock No. 4, for example, remarked that its lockwall masonry resembled the stone structures built by engineers of the Roman Empire. "Kentuckians are like the Romans," he exclaimed, "their public works are to last for ages, and their usefulness is to be enjoyed by countless generations." Another tourist penned a more elaborate detailed description of No. 4:

The Lock and Dam, in the Kentucky River, a few hundred yards below town, is a State work of great cost and magnificence. The Lock, particularly, is one of the most interesting superstructures we recollect ever to have witnessed.

Most stone for the Kentucky locks was quarried near the lock sites and shaped into blocks at a stone yard such as this.



The side walls, which measure about 200 feet in length and 30 feet perpendicular, will be finished, in the very best style of which masonry is capable. The material is gray limestone, quarried in the immediate vicinity and employed with a peculiar quality of hydraulic cement found in sufficient abundance in the Kentucky hills opposite the work. This work with the dam, is estimated to cost about one hundred and twenty thousand dollars; and forms a part of the system of Slackwater Navigation, now in progress on the Kentucky and Green Rivers under the auspices of the State Government. The dam is calculated to afford water for steamboats of two hundred tons for fifteen miles above Frankfort, the year round, and in addition will supply an immense water power for merchant, grist and saw mills in the vicinity.²⁷

In January 1840 the river began its annual winter rise, and Captain Samuel Steele of Frankfort piloted the steamboat *New Argo* upriver past the uncompleted dams to the capital. The *New Argo* was on its maiden voyage from Madison, Indiana, where it had been built for Captain John Armstrong and Philip Swigert specially for the Kentucky River trade. Seizing this opportunity, James Morehead and the Board of Internal Improvement chartered the *New Argo* to take legislators on a downriver excursion to see the new locks. Captain Steele invited the legislature aboard the *New Argo* on the morning of January 18 to cruise down to the new locks, promising to return them to Frankfort by late afternoon. The governor and a hundred legislators crowded aboard the *New Argo* for the cruise, and after they had viewed the locks, Governor Charles Wickliffe and Judge William Owsley convened a special meeting aboard ship. Complimenting Captain Steele and his crew for the "elegant entertainment" provided their guests, they voted approval of a resolution declaring: "The system of improving our rivers by lock and dam navigation has been fairly tested by the experiments this day exhibited to us on the Kentucky River, and that we recommend its prosecution as fast as the resources of the State will permit, without burthensome taxation."²⁸

Whig newspaper editor Orlando Brown of the Board of Internal Improvement was ecstatic. In his *Frankfort Commonwealth*, he proclaimed the locks and dams "a complete triumph to the science that projected and executed the works." He told readers who had not participated in the *New Argo* excursion to walk down to Lock No. 4 and see it for themselves. "Art has triumphed—the genius of Internal Improvement stands vindicated—scoffers are silenced—the fearful are made confident—a new era has dawned on the wealth, power and prosperity of the State."²⁹

Captain Steele fortunately steamed the *New Argo* down the Kentucky and on to Louisville before a winter flood arrived, sweeping downstream the trees cut from the navigation pools the previous autumn. These logs jammed against Dams Nos. 3 and 2 and entirely blocked the channel. Matthew Stealey reported that the jam at Dam No. 3 was a twenty-foot-thick twisted mass of logs filling the river a mile upstream of the dam. When an even higher flood arrived on February 10, it flushed the log jam over Dam No. 3, and Matthew Stealey described its amazing passage: "The drift, in passing over, disappeared beneath the surface, rose below, and was then brought back against the dam with such violence that the shocks might be heard distinctly at a distance of a mile. In this manner large trees were seen to be worn, and rounded off at the ends, by repeated impingements against the dam, until finally the accumulation of their numbers forced them away to make room for others."³⁰

It pleased Stealey that Dam No. 2 on its gravel foundation had held against the onslaught of logs, but he estimated that the log jam had caused structural damages totaling \$11,000. The logs tore off the lower slope of Dam No. 3 and gouged rock from the riverbed below the dam, piling the rock up to form an obstruction in the river channel. In a neat bit of value engineering, Stealey had the workers pick up the broken rock and use it as fill for repairing Dam No. 3. To strengthen the dam's timbercribs against further damages, he ordered the contractor to pin new timbers atop the dam with long iron bolts keyed into the bottom of the dam, rather than merely hammering them in place with iron spikes.³¹



The finished timbercrib dams were planked over and stepped down like a staircase.

On Valentine's Day of 1840, the *New Argo* returned from Louisville, this time piloted by its owner, Captain John Armstrong, who a quarter-century earlier had steered the first steamboat down the Kentucky River. Thanks to a jury-rigged system to open and close the lockgates, Armstrong and his *New Argo* became the first boat to lock through to Frankfort, inaugurating the commercial use of the locks which has continued for more than a century and a half. Armstrong learned he could leave Frankfort at 11 a.m. on Fridays, run to Louisville, and be back at Frankfort by 2 p.m. on

Sunday afternoons, so he inaugurated twice-weekly service between the capital and the Falls City. On one of the first trips, he and the *New Argo* transported the Frankfort Infantry, Lexington Artillery, and Lexington River Raisin Corps to join the Louisville Legion for a Washington's Birthday parade through Louisville. Louisvillians welcoming the troops were treated to a magnificent sight when the *New Argo* rounded Six Mile Island on the Ohio with troops on its deck in formation, flags flying and drums beating. When the Louisville Legion fired a welcoming artillery salute, however, and forgot to remove the rammer, it came close to decapitating the soldiers from Lexington.³²

Stealey operated Locks Nos. 2, 3, and 4 for regular steamboat service until June 1840, when low water in the Ohio River ended the navigation season. He then drew down the navigation pools to repair February's damages and to resume project construction. He completed Locks and Dams Nos. 2, 3, and 4 during that summer except for installing floodgates, the devices placed under the lockgates to wash sediment from the chambers. Partly as a result of funding constraints, however, Stealey could not complete Locks and Dams Nos. 1 and 5 in 1840.³³

The thrill of regular steamboat commerce counted but little among Kentuckians living distant from the river, and great was the uproar when the Governor suggested the legislature should consider increasing state taxes. Members of the legislature delivered philippics against those who had run the state into debt to build turnpikes and locks; now the Commonwealth's credit was gone and capitalists would not lend it more money. These hindsight critics had predicted long ago that the internal improvement program would eventually force the imposition of direct taxes on Kentuckians. Other critics resolved that the state's engineers and their high salaries should be terminated. In response, James Morehead declared that the proposed tax increase was for the state's general fund, not for its internal improvements.³⁴

Asked to review the state's finances and debts, J. Speed Smith of the Sinking Fund committee reported that the Commonwealth's assets equaled its liabilities, which was more than could be said for other states engaged in internal improvement programs. Smith sternly protested that adding more burdens on the Sinking Fund without also increasing its resources through taxation was risky. He warned the legislature that Kentuckians would "neither forget the offence, or pardon the culprit" who spent the state into complete bankruptcy.³⁵

To quell the rumors flying about the state debt, James Morehead asked the Governor for an official financial statement. The Governor reported that Kentucky owed a balance of \$1.8 million on its internal improvement bonds and that the Board of Internal Improvement had loans totaling \$445,000 from Kentucky banks and also owed \$450,000 to its contractors. Altogether, state debts for its transportation projects totaled \$2.7 million. Soon after receiving the Valentine gift in February 1840, the state legislature directed the Board of Internal Improvement to start construction of no additional projects and also to press its contractors to accept state bonds as payment for their work.³⁶

At a raucous meeting on April 7, 1840, the Board met with its contractors and with presidents of the turnpike companies in Frankfort. Board members James Morehead, Samuel Daviess, and Thomas Metcalfe explained to the crowd that they had not a cent to continue construction in 1840 and could offer only state bonds as payment to the contractors. They gave their contractors the option of either accepting the state bonds at par value, or having their contracts suspended. When all the contractors present agreed to accept the bonds, "Old Stonehammer" Metcalfe warned them that the Board would never consider future claims from them based on depreciation of the state bonds or any other alleged loss thereby.³⁷

Cleaning its own house, the Board streamlined its engineering staff through attrition. When Alonzo Livermore resigned as the Green River engineer, the Board took Henry Eastin from turnpike road design and placed him in charge of the Green River. When W. R. McKee, the other turnpike engineer, resigned to become president of Lexington and Ohio Railroad, the Board did not replace him. Assistant Engineer Charles Taylor's illness opened another vacancy that was not filled. The remaining engineers on the Board's staff looked to their future.³⁸

When the contractors received state bonds in payment for their work, they had to sell them for cash at discounts of up to twenty-five percent (\$75 dollars cash for \$100 dollar bonds). Under this circumstance, they proved reluctant to pursue their contract work vigorously. On June 23, 1840, therefore, the Board suspended all the work on Kentucky River and closed its hydraulic cement plant in Louisville. At this time, the lockwalls for Lock No. 1 were completed, but its lockgates had not been installed and only about half the dam was completed. Lock No. 5's masonry walls were completed and half of its dam was in place. At both of these sites, a passage for boats remained open near each dam's abutment.³⁹

Before work stopped in June 1840, Matthew Stealey had identified a serious construction challenge to the completion of Dam No. 1. When excavating the foundation for building the dam's abutment, the contractor about twelve feet down in the excavation encountered a thick stratum of coarse sand. Water boiled up under the cofferdam and through the sand so fast that pumps could not "dewater" the cofferdam. Until the water was removed from the cofferdam's interior, construction could not proceed, and Dam No. 1 could not be completed until this challenge was resolved.⁴⁰

At the end of 1840, Governor Robert Letcher declared borrowing money to build transportation projects and then raising taxes to pay for them was "ruinous policy." Kentuckians should not be taxed to pay for completing internal improvements, and work on the projects therefore should continue only with the strictest economy and patience. Because the state's general budget had operated at a deficit for years and because its sinking fund lacked the wherewithal needed to pay interest on the state debts, the Governor requested a state tax increase. In 1841, the legislature increased the state property tax from ten cents per hundred dollars valuation to fifteen cents.⁴¹

Asked which construction projects could be stopped without serious loss to the state, James Morehead and the Board responded that the contracts awarded contingent on the availability of funds could be suspended, and accordingly they suspended indefinitely the contracts for building a lock and dam on South Fork, for building Locks and Dams Nos. 6, 7, and 8 on the Kentucky, and for additional locks and dams on the Licking and Green rivers. The Board objected to suspending ongoing construction projects, pointing out the amount of damages payable to the contractors due to the stoppage could easily exceed the funds needed to complete the work. The state would have to pay the suspended contractors for the boats, shanty camps, quarries, cofferdams, pumps, and other equipment they had purchased to perform the work. Moreover, the Board asserted that completing Lock and Dam No. 1 on the Kentucky River was critical to "secure a safe passage up to Frankfort," a route especially important to legislators traveling by boat.⁴²

By the 1840s, not only were the Commonwealth's turnpike road and river projects facing bankruptcy, so was its accident-plagued railroad. The Lexington and Ohio Railroad had proven a disaster. The company annually paid four percent dividends on its stock until 1838, when William Owsley and Sylvester Welch discovered it had made no profits whatsoever and dividend payments were little more than a hoax. After firing its treasurer, the railroad company ceased paying divi-

dends or interest on its debts, nor did it repair the tracks. The company had contracted with William LeBarron to bridge the Kentucky River at Frankfort, but LeBarron quickly ceased work when the company did not pay him. The Commonwealth had invested \$200,000 in the railroad's stock, signed notes guaranteeing \$150,000 worth of loans to complete the tracks into Frankfort, and in 1839 it began foreclosure on the railroad's property.⁴³

At a foreclosure sale on the courthouse steps in 1841, Kentucky legally bought the railroad for \$178,544, the amount of its loan to the company plus interest, and made the railroad's management an additional responsibility of the Board of Internal Improvement. Under a negotiated agreement, the Board leased the railroad to former state engineer William R. McKee and transportation magnate Philip Swigert who promised to restore the railroad to public service. With management control of both the railroad and steamboats operating on the Kentucky River, Swigert had established a monopoly that eventually made both railroad and steamboat operations profitable.⁴⁴

Several steamboats named *Blue Wing* plied the Kentucky River. Here, the *Blue Wing* loaded cargo at Louisville with the larger *James Guthrie* behind it. (From Chinn Collection, Centre College.)



Making a Valentine gift of the Kentucky River navigation in February 1840 had not achieved all that the Board of Internal Improvement hoped. Faced with imposing a fifty percent state tax increase, the Governor and legislature in 1840 demanded that the Board suspend all work on its transportation projects to the extent possible without destruction of the completed work. Although the Board suspended its construction of locks and dams upstream of Frankfort, it contended that, with Locks Nos. 2, 3, and 4 in operation, Locks and Dams Nos. 1 and 5 should also be finished for service. Whether the Board's engineers could accomplish this in the face of many difficulties was not certain, however, as the Kentucky River navigation project entered its eleventh hour.

Kentucky River

5

THE ELEVENTH HOUR

Although the direct income which may reasonably be expected from this portion of the original project will not, for some years at least, be equivalent to the interest on its cost; yet it will exercise a beneficial influence indirectly on the business of the country, by facilitating and cheapening the transportation of freight and passengers; and agreeably to all experience, stimulating and enlarging the business of the country in the direct ratio of the extent of the facilities of this description offered to an enterprising community.

Matthew R. Stealey, 1842

Resident Engineer Matthew R. Stealey declared contractor procrastination a major challenge on the Kentucky River project. Neglecting the engineer's directives, the contractors dallied about, left too much work to be done in the eleventh hour, and the result was "hurry, and confusion, and hazard, and sacrifice, and we escape the effects of a flood passing over or around some unprotected or unfinished part of the works by a day or an hour."¹

Stealey recognized that the Board of Internal Improvement and its engineers were not blameless. They had rushed completion of Locks and Dams Nos. 2, 3, and 4 in the winter of 1840, using temporary expedients to make the locks operational for the *Argo's* passage on Valentine Day. As a result, Stealey argued, the flood and logjam of February 1840 heavily damaged the unfinished structures, making it necessary to close down the navigation in 1841 to repair the damages at increased costs to the Commonwealth. Moreover, the sinking of the steamboat packet *New Argo* in December 1841 seemed a direct result of the rushed construction: as the steamboat entered Lock No. 4, a wind gust drove it against the uncompleted and exposed cribwork, forcing a projecting timber through its hull and sinking it immediately. Its wreck lay there for months, blocking navigation until the Board had it removed.²



Logs on a Kentucky River tributary awaiting a flood to float to market.
(From the Filson Club.)

Temporarily opening Locks 2, 3, and 4 in 1840 had done little to mute growing public discontent with the Board of Internal Improvement and its transportation projects. By 1841, the projects had accumulated debts totaling \$3.7 million in the form of interest-bearing state bonds, and the Commonwealth's Sinking Fund lacked \$105,000 of having enough funds to pay the interest due on state bonds. This shortfall forced the legislature to promulgate a fifty percent increase in state property taxes, and as a result the Board of Internal Improvement, its engineers, and its projects became unpopular, indeed wildly unpopular in regions of the Commonwealth not directly benefited by the improved transportation.³

The legislature reorganized the Board to consist of three members: a president and a secretary appointed by the Governor with consent of the Senate plus the state's treasurer. At the same time, the legislature reduced the salaries of the Board president and

secretary to \$500 a year, and paid the treasurer, who had a dual appointment, only \$100. It also mandated pay reductions for state engineers, ordering the Board to pay them no more than a total of \$2,500 annually. With James Morehead's election to the U. S. Senate in 1841, the Governor appointed former Governor Thomas "Stonehammer" Metcalfe as the Board's president. Although instructed by the legislature to dismiss all engineers unnecessary to the service, Metcalfe kept most of them employed during the critical campaign of 1841 to finish Lock and Dam No. 1 on the Kentucky River and other projects at the eleventh hour.⁴

When Matthew Stealey and contractor Joseph Barbour resumed the construction of Lock and Dam No. 1 in June 1841, its lockwall masonry was completed and 300 feet of the dam stretched from the lock across the river toward the abutment, leaving a 200-foot gap in the dam open for the passage of boats. Stealey recruited 220 workers for employment by Barbour during the summer of 1841, and these swarmed around the job, concentrating on excavating the foundation for the abutment at the river bank opposite the lock.⁵

The abutment's excavation was done inside a caisson, a 70-foot-long and 14-foot-wide timbercrib box reinforced and divided by cross-timbers into compartments that were only 6 by 3 feet inside. Workers with shovels crawled down inside the caisson and shoveled sand and clay from beneath its lowermost timbers, allowing the caisson's weight to push it down as the digging progressed. Attached to the caisson's side was a pump, an endless chain of wrought-iron buckets resembling the elevator of a grain mill. Eight horses circled to turn a capstan geared to the chain of buckets, keeping the pump in constant motion carrying water out of the caisson. Matthew Stealey reported that this eight-horsepower pump could remove one cubic foot of sand and water per second, or nearly 700,000 gallons daily, from inside the caisson.⁶

As the caisson and pump worked down through the layer of sand encountered at a twelve-foot depth beneath the river bottom's level, the caisson's bottom timbers met and lodged against a layer of thick blue clay. Resident Engineer Stealey stopped the excavation at this depth and brought a piledriver from Dam No. 2 downstream to the caisson. He planned to drive long and sturdy timber piles, like telephone poles, through the caisson and fifteen feet farther down into the clay, thereby stabilizing the structure on the treacherous foundation and allowing construction of the dam's abutment atop the caisson.⁷

As the caisson sinking progressed, the contractor Joseph Barbour went into bankruptcy, and the Carroll County Sheriff sold Barbour's tools and construction equipment at public auction. Because the construction of Dam No. 1 could not continue without this equipment, the Board of Internal Improvement, by promising reimbursement, persuaded the purchaser to leave the equipment on the job. The Board also appointed Matthew Stealey as the agent for selling the state bonds that the bankrupt contractor received as pay for work completed. Stealey later complained this was done over his protest because it forced him to leave the job and travel to Lexington, Louisville, or Cincinnati to sell the bonds at discount. He used cash received from the bonds to pay the contractor's workers and equipment and materials suppliers.⁸

Chief Engineer Sylvester Welch and Board members inspected the job at Dam No. 1 on September 2, 1841, while Stealey was absent selling bonds. For improved stability at the dam's abutment, Welch, with Board approval, ordered the abutment excavation extended farther into the river's bank and that the caisson be taken down another eight feet, or to a depth of twenty feet

beneath the river bottom. To speed the removal of water from within the caisson, Welch dispatched George Stealey to Cincinnati to purchase a steam engine and larger pump. This surprised Matthew Stealey when he returned to the job, and he strongly protested these changes but to no avail because Welch had the Board's confidence.⁹

While awaiting delivery of the steam engine and new pump, the horses kept circling the pump's capstan, turning the chain of buckets to hoist water from the caisson. The manual excavation inside the caisson became increasingly difficult. Inside the narrow compartments, the workers stood in water and under the drip from scaffolds above them. With picks, they scratched the clay and rocks from beneath the lower timbers and shoveled the material up onto a scaffold above them, where another worker stood to shovel it up to another scaffold, where a third worker shoveled it into wheelbarrows for removal. To keep these workers down in the caisson under these nasty and hazardous conditions, Stealey had to promise them doubled wages.¹⁰

The timber caisson had descended satisfactorily through sand layers, but its descent substantially slowed as it passed down through the rocky clay. Three weeks after Chief Engineer Welch had ordered the additional excavation, the caisson had gone down only another eighteen inches, to a depth of 13.5 feet. There it stopped, prevented from moving, Stealey explained, by "the tenacity and adhesive character of the soil, the pressure of the bank, and probably some points of concealed rocks." George Stealey returned with a larger steam-powered pump and was assembling it on September 23, when Chief Engineer Welch and Board members returned for another inspection. After reviewing the situation, they concurred with Matthew Stealey's recommendation that excavation should cease, and the horses rested after three months of continuous pumping day and night. Chief Engineer Welch assumed temporary control of the job while Stealey left again to sell enough bonds to meet the payroll.¹¹

Board president "Stonehammer" Metcalfe recognized that completing the abutment was critical to the job. "Should the water once find its way under, or around that abutment, through the sand beneath, or sand around and adjoining it, the whole bed of the river would probably be changed in a few hours, and leave the lock and dam high and dry," Metcalfe said, "a monument of the ignorance and folly of those whose duty it was, and who omitted to guard against such disaster." On October 7, Metcalfe and Welch returned total control of the job to Matthew Stealey, instructing him to press the construction to completion regardless of the costs. They also told contractor Joseph Barbour to stand aside entirely and let Stealey finish the job. "I was compelled to look on and see my funds expended," contractor Barbour lamented later, "in an effort to retrieve the mischief."¹²

Workers had fabricated another caisson to extend the abutment's length and assembled timbercribs to fill the gap in the dam when the Kentucky River flooded on October 12. This flood washed away the newly built caisson and cribs and it began eroding the riverbank, devouring it above and below the abutment caisson. Chief Engineer Welch wanted to call an emergency meeting of the Board to suspend the job, but Stealey objected that the coming winter's floods would inevitably flank the dam, opening a new channel as the river rushed through the low land behind the abutment. Stealey's judgment of the emergency prevailed and the work continued. Offering high pay, Stealey recruited more workers, who built new timbercribs and, on October 23, installed a boom of logs linked together by chains across the gap in the

uncompleted dam. They floated the new timbercribs downriver to rest against the boom and positioned them across the gap in the dam. Dumping stone into the timbercribs formed the eighty-foot base of the dam, then they prepared to build the timber superstructure atop the base and thereby curb the Kentucky River near its mouth.¹³

Pushboat with merchandise arriving at Jackson on North Fork of Kentucky River where floating logs are collected in booms.
(From Charles Hayes, Jr.)



During a terrific rainstorm on the evening of November 21, the river began rising at the astounding rate of five feet an hour. The turbulent river tore loose and swept away the contractor's boats and tools, and Matthew Stealey saw it would soon break its way through the low land behind and around the abutment, destroying the project. At the eleventh hour, Stealey strode through the workers' camp, roused them out of their beds, and sent them back onto the river in pitchblack night and lashing rain, hazarding their lives to save the dam and perhaps the entire Kentucky River navigation project. If the flood ate its way around the dam, opening a new channel, it would have required building another dam at great cost and at a time when the legislature might not have provided the funding.¹⁴

In the dark of that windy rainstorm, the workers cut and pitched brush onto the eroding riverbanks, hauled up stone and piled it atop the brush and the abutment crib. Three nights and days, this flood emergency continued, exhausting the workers. By armoring the riverbanks above and below the abutment with stone and by installing timbers to raise the abutment crib twenty-two feet, Matthew Stealey and the workers saved Lock and Dam No. 1 from total disaster. On November 25, 1841, the flood waters subsided, and Captain John T. Brooks ventured upriver from Carrollton with the steamboat packet *Ocean* to pass through Lock No. 1. Stealey's workers opened the gates, allowing the *Ocean* passage upriver and it steamed on through Locks Nos. 2, 3, and 4, becoming the first boat to navigate the completed project. This was a great thanksgiving indeed, although "Stonehammer" Metcalfe's jubilation was tempered by knowledge that Dam No. 1 would require constant monitoring thereafter to prevent more threats of flanking from the river.¹⁵

With the Kentucky River project at last open to Frankfort, in January 1842 Board president Metcalfe directed Chief Engineer Welch to dismiss all the state's engineers except Charles Taylor who remained on staff to complete turnpike surveys. Some, like Antes Snyder, returned to Pennsylvania. William B. Foster went to Cincinnati with his brother, composer Stephen Collins Foster. Alonzo

Livermore joined the Army Corps of Engineers and continued his river project engineering. Napoleon Buford went to Rock Island, Illinois, where his family had a prosperous mercantile business. Matthew Stealey designed the Kentucky State Penitentiary, opened a store and purchased the Mansion House hotel in Frankfort. George Stealey changed careers, becoming a physician and practicing in Frankfort until he joined the California gold rush.¹⁶

"Stonehammer" Metcalfe kept Chief Engineer Sylvester Welch on the Board's staff during 1842 to manage the finishing work and help settle the contractors' claims, especially the large claim by Joseph Barbour. Although Matthew Stealey recommended that Barbour be paid an additional \$11,000 for extra work and trouble at Lock and Dam No. 1, Welch determined that Barbour was due only \$6,000. Although Metcalfe paid Barbour this sum, Barbour appealed his additional claims to the legislature, launching an acrimonious dispute with Metcalfe.¹⁷

In his petition to the legislature, Barbour submitted an \$18,000 claim for contract retainage, for lost profits, and for depreciation of the state bonds used to pay him. Castigating Welch and Metcalfe for their "ill-judged" decisions on abutment and dam construction in 1841, Barbour asserted: "I do trust that the Commonwealth of Kentucky will not permit me to be ruined by the bad judgment, whims or caprice of her agents." Matthew Stealey, who had become Barbour's business partner, urged that the claims deserved consideration.¹⁸

Defending his decision to press the completion of Dam No. 1 regardless of its costs, Metcalfe declared that Dam No. 1 was the key to the entire project; it had to be completed before the Board could begin collecting tolls from the traffic. "The country needed the use of the navigation," he said, and, "The State needed the revenue." He dismissed Barbour's claims entirely, declaring the Commonwealth would have been better served if he had forfeited Barbour's contract in 1841. Moreover, he complained, Barbour had assumed virtual control of the state's property adjacent to Lock No. 1.¹⁹

During the construction, Barbour had built a sawmill next to the lock to manufacture lumber for the dam, and in 1842 he converted the steam engine pump, purchased by the Board and Stealey with his money, to power a flour mill. At a new store opened in Frankfort, Matthew Stealey retailed the flour produced by Barbour at his Lock No. 1 mill. Metcalfe complained that Barbour had erected buildings, moved in tenants to operate his mills, fenced the property and even planted an orchard, all on the state's land. In reply to Metcalfe's protests, Barbour presented a law he obtained through friends in the legislature allowing him the use of the land. To oust Barbour, Metcalfe was forced to seek legislative action.²⁰

Although Metcalfe's altercation with Barbour waxed bitter, even more acrimonious was Metcalfe's dispute with the Licking River contractors whose construction of five locks he had terminated in 1842. On Welch's recommendation, Metcalfe paid these contractors a claims settlement of \$15,000 in 1843, but they went to the legislature claiming \$100,000 additional damages on their suspended work. Labeling these claims preposterous, Metcalfe used the newspapers to attack the contractors who were "swarming" the legislature to pilage the state treasury and obtain "a glorious harvest for themselves and their sympathizing attorneys." Metcalfe publicly classed these contractors with the engineers whose "humbugging knavery" had colluded with the contractors through "notoriously false estimates" of contractors' work.²¹

The bulk of the contractor claims were based on the losses incurred when they were forced to accept the state's bonds in payment. To obtain cash, they had to sell the bonds at discounts of up to twenty-five percent, receiving only \$75 for each \$100 bond. Metcalfe entirely disagreed with this argument, and he mentioned a poor but honest businesswoman of Frankfort who had accepted the contractors' bonds at face value in payment for provisions. He asked whether the legislature intended to help the wealthy contractors while ignoring the damages to small businesses like hers. "We have passed through an extraordinary crisis, such as has but seldom occurred among wise and civilized nations," Metcalfe proclaimed, adding: "Owing to the enormous amount of Bank paper thrown into circulation by the several States, almost universal disorder was scattered abroad in the land. The currency itself being disordered, all the business and property of the country partook of that disorder."²²

In a public reply, the contractors declined to enter into public controversy with a "Board of salaried officers or public pensioners." They asserted that Metcalfe sought to "poison" the legislators against them and to "stifle the voice of injured individuals when demanding justice at the bar of the representatives of the people." When the legislature in 1844 rejected the contractors' claims, they vowed to return every following session until they got justice.²³

After all claims by the Kentucky River contractors had been settled, but not to everyone's satisfaction, the Board made its final report on the amounts paid to the contractors. At the end, Joseph Barbour received \$220,300 for building Lock and Dam No. 1. Rausch & Ferguson received \$151,983 for No. 2; Thomas and Adam Darling received \$135,857 at No. 3; Wilson Knott & Company received \$131,607 for No. 4 and \$137,436 for No. 5. Adding the Board's expenditures for engineering, hydraulic cement, clearing navigation pools, building lockhouses, and similar non-contract expenditures, the project initial costs totaled more than \$800,000. This compared well with the 1836 project cost estimate by Sylvester Welch and Stealey of about \$700,000, but additional claims later came from the owners of land and milldams inundated by the project's slackwater, pushing the total project cost to \$900,000.²⁴

Other than the lock and dam abutment sites, the Board of Internal Improvement had purchased no land to be inundated by the slackwater pools along the Kentucky's main stem. Because of the Kentucky's narrow floodplain, the slackwater had covered little arable land, and Metcalfe argued the improved market access provided by the project increased the value of adjacent land sufficiently to offset any losses. Apparently many landowners agreed with this assessment because they submitted no claims. Farmers and milldam owners on tributary streams, however, did not agree and asked payment of damages for the inundation of their properties.

As he did with the contractors' claims, "Stonehammer" Metcalfe stonewalled the landowners' claims. When E. H. Watson and J. C. Young, for example, claimed the slackwater had inundated their ten acres along Benson Creek in Franklin County, Metcalfe walked the land in person, taking along four independent appraisers. Two of the appraisers thought the added value of the land resulting from the available slackwater transportation was greater than the value of the land inundated. Two others disagreed, allowing damages of \$600. Pointing out that the river had flooded the land every year before the project was constructed, Metcalfe declared the landowners should be paid nothing because "the tract of land in question has received fully as much benefit as damage from the slackwater in the Kentucky River."²⁵

The *Falls City* plied from Louisville, the Falls City, to Valley View on Kentucky River. (From the Filson Club.)



While Metcalfe disputed these damage claims, steamboat commerce on the Kentucky River began to prosper. On high water in 1841, Captain N. B. Barclay took his steamboat *Transit* upriver to Shaker Ferry, and Captain John T. Brooks took the *Ocean* all the way to Boonesborough, the first steamboat to reach that port 176 miles upstream of the Kentucky's mouth and eighty miles above the head of slackwater. After becoming the first steamboat passing through all the locks in November 1841, the *Ocean* initiated regular steamboat commerce upstream of Frankfort, serving Clifton and Munday's Landing.²⁶

A passenger aboard the *Ocean* in February 1842 wrote a revealing account of his trip downriver from Frankfort. Steaming at an amazing thirteen miles per hour, the *Ocean* soon reached Lock and Dam No. 3, which the passenger exclaimed "exhibits superior workmanship and reflects great credit upon the skill of the worthy contractors." He admired Captain John Brooks' skill, neatly steering the *Ocean* into the lock, where it was detained only a few minutes before leaving for Lock No. 2. Because the river was high, Brooks "jumped" the *Ocean* over Dam No. 2 instead of awaiting lockage. This concerned "Stonehammer" Metcalfe and the Board, who wondered whether boats "jumping" the dams instead of passing through the locks should be charged tolls.²⁷

When the rivers fell to low stages in 1842 and delayed the *Ocean's* passage, a newspaper feared that it had grounded and stranded on the Kentucky River. Captain John Brooks responded that his boat had not stranded on the Kentucky since the locks and dams had been completed, but its passage often was blocked by Ohio River sandbars. "Our glorious little stream, the Kentucky, which hitherto scarce afforded a draught for a thirsty ox," crowed the *Frankfort Commonwealth*, "is permanently navigable in the driest season and at the lowest stage of water, when the magnificent Ohio is not." If the federal government did not improve Ohio River navigation the newspaper editorialized, "We'll turn the course of trade and head our steamboats for the Three Forks."²⁸

"The Ohio is unfit for the navigation of a steamer adapted to, and laden for, the navigation of the Kentucky River," commented "Stonehammer" Metcalfe, referring to low water delays at shoals between Louisville and Carrollton. "Having no authority to remove obstructions in the Ohio," he added, "[I] regret to say that that river remains in its natural, wild and rude condition, not yet fitted for the business purposes and enjoyments of civilization—the fact that it has, by eminent authority, been proclaimed an *inland sea* from Pittsburgh to Memphis, notwithstanding."²⁹

Winter ice, however, delayed steamboats on the Kentucky just as it did on the Ohio River. As a courtesy to legislators, steamboats then scheduled trips to transport members from the Green River region by express directly to Frankfort on the Kentucky at the start of each legislative session. Joseph Underwood of Bowling Green was aboard one of these steamers in November 1842, when it turned up the Kentucky River during an early cold snap. Three miles above Lock No. 1, the steamboat hit thick ice and stopped while its crew sheathed the boat's bow with timbers for protection. After breaking through the ice another three miles, the boat captain thought it unsafe to proceed farther and returned to Louisville. Back at Louisville, Underwood disembarked from the steamboat and caught the stagecoach to Frankfort.³⁰

Except when frozen, the Kentucky River project supported a prosperous steamboat commerce during its first years of service. Before the project's completion, one or two steamboats plied the Kentucky during spring high water, three or four months each year. By 1843, however, there were four running daily to Louisville and Cincinnati, reducing freight rates for Kentucky River shippers by half over earlier charges. Captains J. T. Washington and R. A. Clay paired their *Isaac Shelby* with the *Wm. R. McKee* in the trade to Cincinnati, and the *Shelby* served as the first towboat on the Kentucky River when it towed a keelboat down the Ohio and up the Kentucky. To serve the upper river commerce, Philip Swigert and William R. McKee of the Lexington and Ohio Railroad bought the *Little Mail*, a small steamboat drawing only eighteen-inches, and had Captains Thomas Cogar and Samuel Steele pilot it from Mondays Landing, Harrodsburg, and Clifton to Frankfort and Louisville.³¹

Swigert and McKee also owned the *Tom Metcalfe* commanded by John Holton and the swift *Bob Letcher* commanded by Harry Todd in the Louisville trade. Capt. Todd and the *Letcher* in 1843 left Louisville at three o'clock one Saturday afternoon, made six stops, passed the four locks, and arrived at Frankfort before dawn on Sunday, a twelve-hour speed record for the Louisville to Frankfort run. That October, Captain Todd and the *Letcher* took passengers on the first direct steamboat run from Frankfort to St. Louis, completing the trip in two days and eight hours. Swigert and McKee advertised that passengers boarding their steamboats at Louisville and connecting with their railroad at Frankfort and with their stagecoach line at Lexington could reach Maysville on the Ohio River a day earlier than steamboat passengers going directly up the Ohio from Louisville to Maysville.³²



Philip Swigert dominated Kentucky River trade from the 1820s to the Civil War and served as wartime president of the State Board of Internal Improvement. (From Historic Frankfort, Inc.)

Steamboat arrivals
and departures at
Frankfort, 1845.

STEAM BOAT MEMORANDA.

PORT OF FRANKFORT

ARRIVALS.

Sept. 30, Tom Metcalfe, Holton, Louisville.
30, Fashion, -----, Cincinnati.
Oct. 1, Kentucky, Steele, Louisville.
2, Blue Wing, Todd, Louisville.
2, Isaac Shelby, Brown, Cincinnati.
2, Tom Metcalfe, Holton, Louisville.
4, Isaac Shelby, Brown, Cincinnati.
5, Blue Wing, Toff, Louisville.
6, Kentucky, Steele, Louisville.
6, Blue Wing, Toff, Munday's Landing.

DEPARTURES.

Sept. 30, Isaac Shelby, Brown, Cincinnati.
30, Blue Wing, Todd, Louisville.
Oct. 1, Tom Metcalfe, Holton, Louisville.
1, Fashion, -----, Cincinnati.
2, Isaac Shelby, Brown, Cincinnati.
3, Kentucky, Steele, Louisville.
3, Blue Wing, Todd, Louisville.
4, Isaac Shelby, Brown, Cincinnati.
5, Tom Metcalfe, Holton, Louisville.
6, Kentucky, Steele, Louisville.

The Swigert and McKee cartel made the Lexington and Ohio Railroad a feeder to, indeed, a fork of the Kentucky River. As Thomas Metcalfe explained, "The Railroad from Frankfort to Lexington is so connected with the river navigation as to form one continuous line of improvement, the destruction of any link in which, would very nearly be destructive of the whole line." Throughout the 1840s, cooperation rather than competition governed the relationship between Kentucky's river and its railroad.³³

Although steamboat commerce thrived, use of the fall or head at the Kentucky River dams to power manufacturing mills did not materialize as project proponents hoped. To develop this power, a mill-race canal had to be opened beside each dam, and building such races had cost as much as \$12,000 at the dams on Green River. Metcalfe reported the Board of Internal Improvement had no funds to excavate mill races at the Kentucky River dams and the high costs also deterred private enterprise. As demonstrated by Joseph Barbour at Lock No. 1, steam engines could power mills at less initial cost than water-power and, moreover, could be located where damages from flooding was not a concern. The A. R. Scott Company in 1845 agreed to open a mill-race canal at Dam No. 4 in Frankfort to power two sawmills and two gristmills, paying \$240 annually to the state for the lease. Although businesses expressed some interest in water power at Dams Nos. 2 and 3, they did not contract for the development, and the mills opened at Dam No. 4 remained the sole water power developed on the Kentucky River project.³⁴



The State built lockhouses such as this one at Lock No. 3 for its lockmasters.

To begin recovering the investment in the Kentucky River project, "Stonehammer" Metcalfe in 1843 established a lock operations and maintenance program and created a toll collection system. Metcalfe appointed the lock keepers, paying them \$250 a year and providing their housing adjacent to the locks because they had to be present to lock boats at all hours. He purchased existing buildings from Joseph Barbour and James Evans for lock keepers at Nos. 1 and 2 and had J. Montfort construct the lockhouses at Nos. 3, 4, and 5. He appointed R. H. Chittenden as the first Collector of tolls.³⁵

Metcalfe ordered the Collector of tolls to keep an office in Frankfort near the steamboat wharf. When boats arrived, the Collector took their cargo manifests, collected the tolls, and gave receipts to the boat captain or clerk. Returning downriver, the captain presented his receipt at each lock he passed, then surrendered it to the keeper at Lock No. 1. The lock keeper at No. 1 also collected the tolls from boats that did not ascend the river as far as Frankfort. Keeping a two and a half percent commission on the tolls as his pay, the Collector deposited the toll revenues in a Frankfort bank, making quarterly reports of the totals to the Board president.³⁶

The Board required its lock keepers to live at the locks, "ready at all times to pass Boats or Floats with the least possible delay." When not opening lockgates, they maintained and repaired the property, having authority to employ help for emergency repairs. They allowed downstream passage only to boats holding receipts from the Collector at Frankfort, and they had authority to contact law enforcement for boats evading toll payment. When the river rose to two feet over the dams, they hoisted red flags warning descending boats to tie off with stern lines to prevent going over the dam or ramming the upper lockgates. "No Lock Keeper shall be permitted to keep a tippling house, vend spirits of any kind, or suffer any riotous or disorderly conduct at his Lock," said regulations. Because the lock keepers, except at Lock No. 1, had no assistants, regulations required boat captains to tie onto the lockwalls as directed by the keepers and to have their crews assist the keepers with opening and closing lockgates. This was a tiring job, done by walking in circles to turn capstans geared to the lockgates.³⁷

The Board's first toll-rate schedule charged 12.5 cents per ton of freight for each lock passed, 12.5 cents per each lock for cabin passengers, and 6 cents per lock for deck passengers. Flatboats and keelboats paid for 6 cents per lineal foot of length for passing each lock, but boats loaded with Kentucky River coal or salt were granted a fifty-percent toll reduction to encourage the Kentucky's coal and salt merchants. Charges for lografts varied from 3 to 5 cents per lineal foot, depending on the raft's width. Empty steamboats paid 4 cents per registered ton for each lock passed.³⁸

Protests that these "intolerable" rates would suppress commerce greeted the Board's first announced rate schedule. Newspaper editors complained the project's purpose was to encourage commerce and promote convenient transportation, and "to divert it from these purposes and to erect it into an oppressive tax gatherer is not only unwise but exceedingly unjust."³⁹

In response, Metcalfe and the Board quickly revised the rates downward. To encourage competition and foster regular schedules, they exempted empty boats from tolls and charged only for freight and passengers. On the logic that the project had created upstream commerce but only improved downstream commerce, the Board charged less for descending export cargo than for ascending import cargo. Although it had hoped to obtain enough revenue from tolls to pay operations and maintenance costs and also the annual interest due on the state's bonds, it decided that high tolls might interdict use of the project. Because the competition was "between the river navigation and the wagons" on the turnpike roads leading to the Ohio River, the Board feared that high river tolls might divert freight from the river to the wagons traveling the turnpikes.⁴⁰

Metcalfe lamented that the lower toll rates might not pay for operations and maintenance and also pay interest on the state's investment, predicting that securing an adequate return on project costs of \$900,000 might prove difficult. He observed that the project's construction costs had been four fold greater than R. Philip Baker's "erroneous" 1835 cost estimate, and he admitted that the Commonwealth might never have begun the project had it known the true costs. "But this now ranks among the events of the past," he concluded, "and need not be recalled to mind, except as a matter of history, and to furnish a warning beacon to the future."⁴¹

Revenues during the project's first year of operation were excellent. Collector R. H. Chittenden reported receiving \$115 in December 1842. In 1843 he collected a total of \$7,737 on 4,000 tons ascending freight, 7,500 tons descending freight, 9,625 passengers, 187 horses, and 18 head of cattle. From this revenue, the Board paid salaries to lock keepers totaling \$1,000, paid \$300 to the collector, and \$270 for maintenance tools, returning the \$6,000 balance to the state treasury.⁴²



Lockmen opened the lockgates by turning capstans on the lock walls. This is at Lock No. 1.

Although recognizing that annual maintenance costs would vary depending on the amount of damages caused by floods and drift and the volume of sand and mud deposited in the lock chambers and entrances, Metcalfe foresaw a bright project future. He hoped that the annual repair expenses would not exceed five thousand dollars, leaving a balance for retiring the Commonwealth's investment.⁴³

Retiring to a farm near Frankfort, Chief Engineer Sylvester Welch became a consulting engineer for planning new railroads in Kentucky, and Metcalfe and the Board of Internal Improvement occasionally employed him or Matthew Stealey, owner of the Mansion House hotel, during emergencies. "A regular salaried Engineer upon the Kentucky river navigation would be a sinecure," Metcalfe explained: "The frequent and regular trips of the steamers passing up and down, affords to the Lock Keepers an opportunity of communicating to the Board prompt information of any accident or other occurrence at any point requiring attention; and the Lock Keepers themselves are required to assist in making such repairs as are likely to be needed."⁴⁴

Metcalfe's disillusion began at the eleventh hour of August 20, 1843, when the lower gates at Lock No. 1 failed and swept downriver. When this news reached Frankfort, Philip Swigert and Austin Cox, the Board's secretary, awakened Matthew Stealey at his hotel to ask his advice on the repairs, and Cox and Stealey set off for the lock. After viewing the wreckage, Cox straightway left for Cincinnati to contract for building a new set of replacement lockgates because the Board had no spare gates. Stealey blamed this disaster on the lock keeper, who had not warned of earlier breakage of timbers and bolts in the gates, and ultimately blamed it on Metcalfe's failure to employ engineers for monthly structural inspections. Stealey's critical report fell into the hands of the *Louisville Journal*, which published it.⁴⁵

Furious, Metcalfe published a full-page critique of Stealey and his report in the *Frankfort Commonwealth*, calling Stealey a "greedy foreign adventurer." Stealey, as resident engineer on the project, was ultimately responsible for the lockgate failure as a result of his lack of quality control—the gates should have lasted ten years. Metcalfe accused Stealey, "this Ajax of slackwater," of attempting to persuade the legislature to replace the Board with a new Public Works Commissioner—himself.⁴⁶

Editors of the *Commonwealth* granted Stealey an opportunity to reply, which he did in an even longer diatribe accusing Metcalfe of bloated official arrogance and "libelous, foul-mouthed slanders." Because Metcalfe was ignorant of river engineering, Stealey suggested that he at least employ an able superintendent. Metcalfe saw merit in this and hired Thomas Conn, formerly an engineer on the Lexington and Ohio railroad, as the Superintendent of Kentucky River Navigation, making him responsible for the project's maintenance.⁴⁷

While new lower lockgates were fabricated, navigation continued upstream of Dam No. 1 because the upper lockgates still stood in place holding the upstream navigation pool. The accident caught the steamboats *Bob Letcher*, *Tom Metcalfe*, and *Ocean* upstream of the lock and the *Little Mail* below the lock. Their captains arranged for the *Metcalfe* to operate from Frankfort to the lock, transferring its cargo and passengers around the lock to the *Little Mail* for delivery on to Louisville. This transshipment arrangement served until Metcalfe had the new lockgates fabricated and installed.⁴⁸

Commenting on the lockgate accident, the *Frankfort Commonwealth* regretted that the Board so severely cut its expenditures that it had no duplicate replacement lockgates at hand. "We trust this accident will admonish the Board of Internal Improvement," it concluded, "to be provided in future against similar disaster."

The Board soon purchased spare lockgates and built a 250-foot long warehouse adjacent to Lock No. 4 for storing the gates, spare parts, and tools. It also changed the lockgate design, replacing the original lockgates with a design patented on the Monongahela River by Henry McCarty. The first lockgates had turned open on rollers atop a rail placed in an arc on the bottom of the lock chambers; McCarty invented a suspended lockgate that could swing open like a house door, and the Board paid him \$1,000 for the use of his design on the Kentucky. This design abated problems experienced when rocks lodged on the rails under the lockgates and blocked their movement.⁴⁹

It became the Board's custom to delay the Kentucky River's project maintenance each year until the low-water season of late summer and autumn. Then, the lock keepers opened the valves and gates to drain the pools, exposing the dams and lockgates for repairs. Because the timbercrib dams leaked badly, each year they were graveled—gravel dumped on the upstream side of the dams plugged crevices and stopped or slowed the leakage. After the pools were drained during one repair season, Metcalfe received another eleventh hour maintenance lesson. While the pool upstream of Dam No. 1 was empty, the Ohio River suddenly rose, sending its backwater up the Kentucky and spilling over Dam No. 1 backwards. "This heartless and clandestine outrage came upon us like a thief in the night," Metcalfe lamented. The Ohio passed backwards through the holes in Dam No. 1, opening them further and washing away the gravel dropped to plug the upstream side. When the Ohio fell and the Kentucky rose, the Kentucky freely drained through the new holes and emptied the pool. In this crisis, Metcalfe hired Sylvester Welch to manage the extensive repairs and graveling, but as this work at Dam No. 1 neared completion a whirling eddy washed away bottomland at the abutment of Dam No. 5, threatening the abutment itself and forcing emergency work there.⁵⁰

"Stonehammer" Metcalfe soon recognized that operations and maintenance on the Kentucky River was one dam thing after another. "It must not be forgotten that this line of navigation is artificial and not natural," he declared: "that it has cost the State many thousands to build it; that it will continue to cost, annually, a considerable sum to repair and uphold it; that it is liable to sudden and unforeseen accidents of a destructive character; and that the natural decay of the wooden portion of the structures is such, that the cribs &c. above low water mark, will, at no very distant day, require to be rebuilt."⁵¹

To pay these maintenance costs, Metcalfe and the Board sharply increased toll rates in 1844, ending the toll differential allowed for descending export freight. This increased overall revenue but drove some boats from the Kentucky River trade. Complaining the higher rates would cost them \$10,000, making the trade unprofitable, and that the Board showed favoritism to boats owned by Philip Swigert and the railroad company, owners of the *Isaac Shelby* took their steamer out of the Kentucky River. Metcalfe responded that higher tolls were necessary and the rates applied equally to all boats on the river. He pointed out that Kentuckians living distant from the river thought the tolls should be high to generate revenue for retiring the state debt, and a bill mandating even higher toll rates had recently passed the House but lost in the Kentucky Senate. Editors of the *Frankfort Commonwealth* observed that, although the Kentucky River dams leaked rather badly, its navigation "remained more respectable than the *Belle* [Ohio River]."⁵²

During its first five years, the Kentucky River project returned respectable sums to the state treasury. It paid \$6,194 in 1843 and \$8,569 in 1844. After tolls were increased, it paid \$25,456 in 1845, \$22,531 in 1846, and \$31,892 in 1847. The

\$94,643 total far exceeded returns on the Green River project, which paid \$14,448 in the same five years. The Lexington and Ohio Railroad paid nothing, remaining a drag on the state budget, and total returns from all the turnpike companies were less than from the Kentucky River. Editors of the *Frankfort Commonwealth* thought river commerce vital to the town's prosperity, and they declared the slackwater project a major factor contributing to a doubling of the town's population between 1840 and 1845.⁵³

Some legislators continued their interest in extending slackwater farther up the Kentucky River toward the Three Forks, and the first mark of their interest came in 1844 when the Senate directed the Board to report on raising the height, or lift, of Dam No. 5. This would extend slackwater an additional twelve miles to serve ports in Jessamine and Woodford counties. The Board pointed out that raising the dam higher also forced raising the lockwalls and abutment along with armoring the river banks. The Board estimated that increasing its height by 2.5 feet would cost about \$9,000, but perhaps would stimulate an increased commerce and toll revenue. The legislature promptly authorized this increased height, if the counties and persons benefiting from this work provided the construction funding.⁵⁴

Although raising Dam No. 5 was not funded, additional support for extending the slackwater project upstream came after Captain Harry Todd took advantage of a rise in March 1846 to fly upriver on the *Blue Wing* to Irvine, the first steamboat to approach this town. "The *Blue Wing* skimmed like a bird over the waters, and its beautiful prow cleaved its foamy track through the angry tide in places where steamboats were by no means recognized as acquaintances," the *Richmond Chronicle* reported: "The inhabitants stand aghast. The fire breathing monster is among them. The thunder of his loud bellowing is heard far echoing along the shore."⁵⁵

Kentucky River

6

SLACK WATER AND DAMS

Nothing is now needed but the extension of this grand improvement to the three forks of the Kentucky River to make it the best, cheapest, and at the same time one of the most profitable public works in the United States. By this extension the mineral wealth of our mountains will be made tributary to our rich valleys; and by a natural reaction, the capital and agricultural products of the valleys will cause the wild and sterile mountains to resound with the cheerful and happy music of the loom and the anvil.

Owen G. Cates, 1850

The steamboat *Blue Wing*'s spectacular flight up Kentucky River to Irvine during the flood of 1846 stimulated renewed support for building more locks and dams to tap the resources of the Upper Kentucky valley. To nudge forward this project extension, slackwater advocates convened at Irvine and Richmond and organized companies to fund and undertake the construction of more locks and dams upstream of Lock and Dam No. 5. The Mexican War from 1846 to 1848 diverted Kentucky's attention from its transportation needs, however, and efforts to extend slackwater to the Three Forks made no progress.

Although Kentucky volunteers traveled the river on their way to Mexican combat theaters, dams at the existing five locks hampered regular commercial navigation, challenging "Stonehammer" Metcalfe and his successors as president of the Board of Internal Improvement, Owen G. Cates, J. Speed Smith, and David Rice Haggard. Each applied distinctive philosophies to managing the Kentucky River, and all ended, figuratively, in the muddy water trying to shore up the dams. As the timbercrib dams aged and deteriorated, their structures slumped down, bowed out in the middle, and leaked like sieves.

During the 1840s the Kentucky River slackwater project collected more in toll revenues than were expended on its operations and maintenance, and these revenues were returned to the state treasury. Completion of the railroad from Frankfort to Louisville in 1851, however, soon grabbed commerce from the river, eroding the slackwater project's revenues. The loss of commerce in combination with increasing operations and maintenance costs brought the Kentucky River project to its first annual deficit in 1854, and in most years thereafter it became a burden on the state treasury. Although the Board of Internal Improvement made every possible reduction in costs, failures of the aging dams brought the project to the brink of collapse by 1860.

* * * * *

The arrival of the *Blue Wing* at Irvine in 1846 revived public interest in the resources of the Three Forks and in building more locks and dams on the river to tap into them. Lexington businessmen purchased lands and coal mines near the new towns of Proctor and Beattyville at the Three Forks because firewood near Lexington and Frankfort had been nearly exhausted by 1846, and coal was becoming the fuel of choice, especially to power new steam engines at manufacturing mills. Recognizing this trend, Captain Harry Todd of the *Blue Wing* gave up the steamboat trade and instead piloted fleets of coalboats down the Kentucky from the Three Forks to Clays Ferry and Frankfort.¹



A steamboat, probably the *Favorite*, passing Proctor at the head of the Kentucky River. Visible at its bow is a pushboat.

At small mines along the Three Forks, miners worked coal seams outcropping on hillsides fronting the river. Digging the coal by hand, they pushed it out of the mines in wheelbarrows running on wooden rails or trams to riverside, where they dumped it into coalboats—wooden barges resembling the pioneer flatboats. Some coal went to fuel steam sawmills at Proctor, some to heat brine at the Goose Creek saltworks, but most went downriver to Lexington, Frankfort, and occasionally to Louisville.²

When filled with coal, the boats lay grounded on sand and gravel bars to avoid the expense of bailing water until the Kentucky River rose to a tide sufficient to float them to Clays Ferry landing near Lexington or on to Frankfort. At Clays Ferry, the coal was transferred from boats into wagons pulled by six horses; each wagon hauled 200 bushels of coal fifteen miles up the turnpike to Lexington where the coal sold for twenty-two cents a bushel. Enjoying all-river delivery, however, Frankfort businessmen could purchase it for fourteen cents a bushel. Although Captain Todd and other coalboat pilots sometimes wrecked on obstructions or in ice while descending the river, prospects for the future coal trade on the Kentucky seemed promising, especially if more locks and dams were built on the river upstream of Lock and Dam No. 5.³



Loading coal barges on the Upper Kentucky River.

Soon after the *Blue Wing* reached Irvine, river promoters gathered there to urge extension of the slackwater project upstream “from the head of the pool of Lock No. 5 to the mineral regions of the mountains.” Such an extension, they contended, would increase traffic and enhance toll revenues, perhaps sufficiently to retire the Commonwealth’s bonded debt on the project. They scheduled a slackwater convention at Richmond and asked all counties bordering the river to select delegates to represent their interests at the meeting.⁴

Nine counties sent delegates to the May 1846 Slackwater Navigation Convention at Richmond. Sylvester Welch, formerly the state’s chief engineer, headed the delegation from Frankfort, and J. Speed Smith of Garrard County chaired the convention’s organization. Smith appointed a committee led by Cassius M. Clay to summarize the consensus of the convention in resolutions to be addressed to the state legislature. The convention resolved that the Commonwealth had promised to complete the slackwater project upstream to the Three Forks and the time had come for the state to fulfill its pledge. It declared its support for “navigation of the Kentucky River from its mouth to the mineral region deeply into the mountains, not only as a means of facilitating commerce and reducing the price of transportation, but also as tending in an eminent degree to consolidate our people, to develop the natural re-

sources of our State—increase its manufactures, and in many ways, advance its general prosperity.”⁵

When the state legislature responded by asking Thomas “Stonehammer” Metcalfe to report on the feasibility of extending slackwater upstream to the Three Forks, Metcalfe asked Sylvester Welch to review and update his 1836 survey of the upper river. Welch reported that the estimated costs of building twelve more locks and dams upstream of No. 5 could be reduced by design changes, perhaps by building the locks with rough instead of hewn cut stone and lining the inside of the lock chambers with planks. This and similar cost-cutting changes might lower the total costs of building another twelve locks and dams from \$2 million down to \$1.5 million. Metcalfe endorsed Welch’s report and submitted it to the legislature.⁶

Governor William Owsley, a Whig who once served as president of the Board of Internal Improvement, disapproved of embarking on new transportation projects such as extending the Kentucky River slackwater. He observed that 1846 had become a turning point, the first year since Kentucky began its internal improvement projects that the state deficit had been reduced and the first in which its people could look forward to retiring the state debt. “This desirable state of things cannot be brought about,” he said, “if the State engage in new works of improvement.”⁷

Although reluctant to fund building more locks and dams on the Kentucky River, the legislature in 1847 approved the concept and chartered three companies to accomplish the work. The Anderson, Mercer, and Woodford Navigation Company was to build Lock and Dam No. 6; the Jessamine, Boyle, and Garrard Navigation Company was to build Lock and Dam No. 7; and the Fayette, Madison, Clarke, and Estill Navigation Company was to start with Lock and Dam No. 8, followed by Nos. 9 and 10. The legislature authorized each company to sell \$60,000 in capital stock and to employ an engineer and contract for construction as soon as each had sold \$10,000 worth of stock. The companies were to amortize this investment through tolls collected from river commerce.⁸

Chartered in the midst of the Mexican War, the three navigation companies excited no public interest and found no funding sponsors. The 1846 convention at Richmond had ended its deliberations by resolving to “devote our utmost energies to the prosecution of the war with Mexico.” And indeed, mobilization for the war so engrossed the Commonwealth that neither the press nor the legislature gave further consideration to the slackwater project until after the war ended.⁹

Kentucky volunteers boarded boats and descended the Kentucky and Ohio rivers to Louisville, where they transferred to larger boats bound for New Orleans and the combat theaters. Steamboats on the Kentucky took the troops to war and brought them back. They also returned the bodies of the heroes, including former Kentucky engineer William R. McKee, who lost their lives at Buena Vista and other battles. Captain John Holton and his *Sea Gull* brought the coffins upriver to Frankfort for state funerals and burial in the new cemetery developed by Philip Swigert, Matthew Stealey, and Frankfort civic leaders on a hill overlooking the Kentucky River.¹⁰

Engineering education in Kentucky also suffered during the Mexican War. The Bacon College of Engineering, founded by Thornton Johnson at Georgetown, closed. With the collapse of internal improvement projects throughout the nation and a resulting loss of job opportunities for engineers, the public lost interest in Bacon College and its engineering courses. Taking advantage of interest in military service inspired by the Mexican War, Thornton Johnson and his colleagues replaced Bacon College with the Western Military Institute, founded in 1847 at Georgetown to train the officers who led American armies during the Civil War and subsequent conflicts into the twentieth century.¹¹

Near the end of the Mexican War, Lexington businessmen purchased two steamboats to initiate commercial service on the Kentucky River upstream of the slackwater project. The 65-ton *Monterey* and 47-ton *Greenwood* had less than half the cargo capacity of steamboats usually operating on the Kentucky River, but small dimensions and shallow draft were imperative for navigating the unimproved channel upstream of Oregon, Kentucky. A newspaper reported the *Greenwood* "has great power, draws but little water and is built very low between decks....She has a comfortable little cabin, and is otherwise as well arranged as any craft of her size that we have seen." In 1848 the *Greenwood* became the first steamboat to ascend the Kentucky River to the Three Forks at Proctor and Beattyville.¹²

These little steamboats could navigate the Upper Kentucky only on the high water of winter and spring tides, and even then navigation was hazardous. In December 1848, the *Monterey* hit a snag at the mouth of Paint Lick Creek (River Mile 146) and sank in nine feet of water. After raising it, the owners sold it south. Operating from Clays Ferry to the Three Forks, the *Greenwood* probably towed empty coalboats upstream. It proved unprofitable, however, and its owners sold it after just two seasons. Lexington businessmen then organized a Kentucky River Railroad Company in 1852 to build a double-track railroad to the Three Forks. Their railroad project also failed, and forty years elapsed before a railroad was built as far into the mountains as the Three Forks.¹³

President Thomas Metcalfe of the Board of Internal Improvement vigorously advocated extending the Kentucky River project upstream. In his opinion, savings in transportation costs accruing from the existing locks and dams had far exceeded the total amount of state taxes paid by the counties bordering the river. Like Governor Owsley, however, the means of funding the project extension troubled him. He suggested the state legislature might apply the net proceeds from Kentucky River tolls toward the construction of Lock and Dam No. 6, followed by more structures upstream as funding became available.¹⁴

Metcalfe contracted with Sylvester Welch in 1848 to examine and report on the conditions of the five existing locks and dams. Welch found that floods were again eroding the riverbanks at Dam Nos. 1 and 2 abutments and they needed additional armoring with stone. Locks and Dams Nos. 3 and 4 appeared to be stable, but the lockgates at No. 5 needed replacement. Welch estimated that annual project maintenance costs would not exceed \$7,000 for several years, but he warned that deterioration of the timbercrib dams would require major and expensive reconstruction within five years.¹⁵

Elected to the U.S. Senate in 1848, "Stonehammer" Metcalfe left the Kentucky River project in stable, indeed profitable, condition. Personally, he was in less stable condition than the project because his horse had fallen and rolled on him during a river inspection trip. He served in the Senate only a year before retiring to his Forest Retreat home in Nicholas County.¹⁶

In June 1848 the Governor appointed Owen G. Cates as the new president of the Board of Internal Improvement. A graduate of Transylvania University, Frankfort attorney, and law partner of John J. Crittenden, Cates at his appointment to the Board had served as Kentucky's Attorney General for a decade. It brought criticism when he continued to serve as both the Attorney General and Board president, drawing two salaries, because he wanted to complete pending cases before resigning as Attorney General.¹⁷

After resigning as Attorney General, Cates personally inspected the Kentucky River project and thoroughly reviewed the Board of Internal Improvement's policies. On the Kentucky, he reduced tolls substantially from the levels maintained by Metcalfe, especially those on pork and hemp shipments. These reductions aimed to

encourage Kentucky's hemp manufacturers, who were losing trade to imports, and its pork slaughter and packing houses that had opened by 1848. Pork slaughterhouses operating at Lexington, Frankfort, and at Oregon, the head of Kentucky River slackwater, shipped their product by river to Cincinnati, known by 1848 as "Porkopolis." Cates also considered these toll reductions imperative to retain commerce on the river project when the railroad from Frankfort to Louisville, then under construction, provided a faster, alternate transportation to markets.¹⁸

Responding to complaints that the bridge over the Kentucky River at Frankfort obstructed navigation, Cates investigated and concluded it did. At higher river stages, steamboats could not pass under the bridge until the river receded. In his opinion as an attorney, however, Cates noted the bridge had existed before the Commonwealth's locks and dams were built, and Metcalfe had not objected to the bridge's reconstruction during the early 1840s. Complainants also alleged that driftwood collecting in piles against the bridge piers obstructed navigation. Noting that this obstruction provided firewood for heating in the winter, and that Frankfort's trustees considered the piles of wood "relief to their poor, and at the same time an ornament to their city," Cates promised he would have the driftwood removed when and if it became a serious nuisance.¹⁹

After reviewing the Board's fiscal management, Cates instituted major changes to "superinduce a more prompt and lively action in those directly managing the details of its business, and at the same time cause a more strict and rigid accountability in aid of a wise and prudential economy in its entire administration." Learning that the Green River Superintendent Dillis Dyer expended the collected tolls directly on project maintenance without first depositing them in banks as required, Cates objected this was improper accounting. When Dyer did not comply with revised accounting procedures, Cates dismissed him and brought Alonzo Livermore, the construction engineer, back as the Green River Superintendent. Finding that Board secretary Austin Cox requisitioned funding for Kentucky River project repairs without first securing the full Board's approval, Cates declared: "I am of the opinion the funds drawn from the Treasury for repairs on the Kentucky River have not been used as they should be." Being independently wealthy, Austin Cox responded to this criticism by promptly resigning.²⁰

The cholera epidemic of 1849 disrupted Cates' efforts at project maintenance on the Kentucky River. This epidemic spread upriver from New Orleans via steamboats, and Captain John Holton and his steamboat *Sea Gull* brought cholera to Frankfort in July 1849. Holton boarded an apparently healthy passenger at Madison, Indiana, but he became ill aboard the boat and died by the time it docked at Frankfort. Within a week, other cases developed at Frankfort and many deaths followed. Thomas Conn, the Kentucky River Superintendent in charge of project maintenance, was one of the victims. Travelers carried the cholera infection with them, and eventually the epidemic even reached Forest Retreat in Nicholas County, taking the life of "Stonehammer" Metcalfe.²¹

As Conn's replacement, Cates hired Captain Samuel Steele of Frankfort who had commanded the steamboats *New Argo*, *Kentucky*, *Little Mail*, and *Grey Eagle*. Cates and Captain Steele sought to press on in 1849 with project repairs but "the great dread of cholera," Cates reported, "caused much difficulty in the procurement of labor and material." Erosion of riverbanks below Dams Nos. 1, 2, and 3 threatened to destroy them, and by offering high wages Cates and Steele employed enough workers to build timbercrib breakwaters immediately below each dam abutment. Settlement had occurred as well at Dams No. 1 and 3, and these slumping dams no longer held pools with depths sufficient for the entry of fully laden boats into Locks Nos. 2 and 4. As a temporary remedy, Cates ordered twelve-inch timbers bolted atop the dam crests to raise them and the pools they held by another foot.²²

To improve project operations, Cates ordered the construction of a warehouse at Lock No. 4 and new lockhouses at Nos. 1 and 2. The lock keepers at Nos. 1 and 2 lived in shanties purchased in 1841 from the contractors, and Cates ordered the construction of comfortable lockhouses for them and their families to encourage them in their "many important and dangerous duties." Before 1849, the Board leased warehousing to store maintenance tools and spare parts at a cost of \$150 a year. On state property adjacent to Lock No. 4 at Frankfort, Cates had a large warehouse built for \$225 to store the equipment, thereby eliminating the leased space's drain on the project maintenance budget.²³

To remove sand and gravel bars obstructing the channel at various points, Cates contracted for the construction of a dredge boat. John Hulme, who had managed the Board's hydraulic cement plant at Louisville during construction, became the general contractor for building this steam-powered dredge. Hulme subcontracted the wooden hull's construction to the Howard Yard at Jeffersonville, Indiana, and its steam engine and dredging equipment to W. H. Grainger. Delivered at a cost of \$6,298, the dredge began clearing river channels in August 1849. Named the *Slackwater*, its steam engine turned an endless chain of iron buckets that scooped up sand and gravel from the channel and dumped it into scows for removal.²⁴

Cates warned in 1850 that completion of the railroad linking Lexington and Frankfort with Louisville on the Ohio and of other connecting railroads funded by the cities of Cincinnati, Covington, Maysville, and Danville would drastically affect Kentucky River commerce. Because the railroad would speed traffic from Frankfort to Louisville in sixteen hours less time than the trip could be made by river, the railroads would quickly take passenger and packaged freight from the river trade, with resulting loss of toll revenues on the river. Believing the river could still transport bulk commodities such as coal, iron, and salt more economically than railroads, Cates urged that survival of the Kentucky River project ultimately depended on extending it upriver to the Three Forks where these resources were abundant.²⁵

Cates was pleased to report that "amidst the blighting effects of the cholera on the commerce" the Kentucky River carried more tonnage in 1849 than in earlier years, making it one of the more profitable public works in the nation. Again, he urged building more locks and dams on the Kentucky, pointing out the original project "plan of march was onward and upward to the mountain wealth." Cates thought locks and dams on the Upper Kentucky might be designed with higher lifts, thereby reducing the number of structures above Lock and Dam No. 5 to nine. Estimating the Commonwealth could build these nine for \$80,000 each, he predicted the waterways transportation thus provided for the coal, iron, and salt of the Three Forks would, within fifteen years, repay the Commonwealth's entire public debt.²⁶

When Cates resigned in 1850 to move to St. Louis, the legislature had under consideration a bill abolishing the Board of Internal Improvement. Pending enactment of this bill, the Governor appointed J. Speed Smith, state senator from Garrard County who chaired the Senate committee on internal improvements, as the tem-

Strader's Hotel at Carrollton sought business from steamboat passengers. (From *Frankfort Commonwealth*, January 9, 1850.)

To Passengers on the Kentucky River.

STRADER'S HOTEL,

Carrollton, Ky., Mouth of Kentucky River,

D. W. STRADER, PROPRIETOR

THE SUBSCRIBER would respectfully inform the traveling community, that he has taken the above named HOTEL for a term of years, and fitted it up in a style second to none in the West, and Passengers that arrive here at any hour of the night, will always had attentive Porters ready to carry their Baggage to and from the Hotel, and Passengers that get here too late for the Mail Boats, out of the Kentucky River, need have no fear that they will not get a Boat for Louisville or Cincinnati, as the proprietor has engaged a competent watch to hail the Boats for their accommodation. The subscriber will neither spare pains or expense to give satisfaction. This House is in 20 yards of the landing of the Boats, and the subscriber hopes by strict attention to business, to merit a liberal share of public patronage.

D. W. STRADER

Carrollton, Ky., January 19, 1850-

porary replacement for Cates. Senator Smith had chaired the 1846 slackwater convention at Richmond, and he supported the upstream extension of the Kentucky River project.²⁷

If Smith expected to serve merely as project caretaker, he was sadly disappointed. During the prolonged drought of 1850, the Kentucky reached its lowest stage of record. Its puny flow did not replace the leakage through the dams, forcing Smith to suspend river navigation on September 14 and continue it for two months. This low-water suspension afforded an opportunity for repairing the leaky dams, but Smith worried about the health effects on laborers standing in river mud and water. "Water courses are considered the great highways of that dread scourge, the cholera, and other malignant diseases," Smith observed. Nevertheless, he ordered Captain Steele to proceed straightway with the repairs.²⁸

After recruiting sufficient labor, Smith and Steele started the repairs at Dam No. 1 and proceeded upstream. Since its completion in 1841, Dam No. 1 had moved a foot or more downstream of its original foundation, and when Smith tore into the dam he learned the reason. Smith was amazed that the timbercribs contained little stone filling and had been assembled with round hickory and oak trees with the bark still on, instead of hewn white oak timbers. So crooked were these tree trunks that water easily passed through the gaps between them, making attempts to plug the leaks a wasted effort. To remedy these defects, Smith ordered many tons of stone dumped into the cribs and had overlapping sheetpiling driven across the dam's upstream face to cover the trees. Smith thought this lapped sheetpiling formed a barrier compact enough to catch leaves, twigs, and grass that would seal even the smallest leaks.²⁹

Smith directed similar repairs on a smaller scale at Dams Nos. 2, 3, and 4, and he addressed a trouble developing at Dam No. 5. Water dashing over Dam No. 5 created a whirling eddy below the dam that eroded the adjacent river banks. "Flats and other craft were frequently forced into this boiling and angry pool,

where they were in great peril," Smith lamented, "and great exertions were necessary for their extrication; indeed, sometimes, nothing short of destruction is the penalty of their misfortune for being drawn within its vortex." To check this swirling hazard, Smith had a durable cribwork breakwater built as a guidewall to protect boats entering or leaving the lower lock entrance.³⁰

Repairs to Dam No. 4 at Frankfort. In the background is the Kentucky River Mills, which used water power to manufacture hemp twine.



The state legislature in 1849 and 1850 considered bills to clear obstructions from the Upper Kentucky River and to fund the construction of additional locks and dams, but in March 1850 these failed by an 18 to 17 vote in the Senate. This proved to be the final chance for state projects proposing to provide slackwater navigation to the Three Forks. A convention met in 1849 to revise Kentucky's Constitution, and the delegates thought inadequate the average return of less than two percent annually on the Commonwealth's \$5 million total investment in transportation projects. In its revision of the Constitution, the convention's delegates showed no faith in the legislature's judgment; it mandated that the Commonwealth never again borrow funds to build transportation or other public works except after approval by voter referendum. During the debates over the new

constitution, a proponent explained: "When the people vote a debt to be made, they will vote a levy upon their property to pay the interest, and provide for paying the principal. There will be no appropriations then, for creeks and bayous, of thousands of dollars to buy votes of members for appropriations to rivers and roads."³¹

When the new Constitution became law in 1850, the state legislature could fund no new projects except out of existing general revenues, or through voter referendum on tax increases for the purpose. Under this constitutionally mandated process, rather than funding extensions of the Kentucky River slackwater project upriver, the legislature in 1852 chartered a Kentucky River Navigation Company, authorizing it to raise the necessary funds through corporate and local government subscriptions. This company employed George Stealey, the construction superintendent when the first locks were built, to survey the upper river and plan the slackwater system. Stealey had returned from the California gold fields a wealthy man in 1852, and he devoted much time during the next decade promoting land and resource development in the Three Forks area and the locks and dams needed to transport these resources to markets.³²

In his survey report, Stealey reviewed the Kentucky River project history and analyzed its economics. During its early years of operation, the project collected an average of \$25,000 a year in toll revenue and cost an annual average of \$12,000 to operate and maintain. Although recognizing this profit margin was encouraging to investors, he contended that building ten more locks and dams at a cost of \$1.1 million to reach the Three Forks would foster a growing coal and mineral export by river. He estimated tolls on this increasing traffic might climb to \$150,000 annually while project maintenance costs grew only to \$36,000 a year, leaving a \$114,000 annual profit—a ten percent dividend on the \$1.1 million invested. Describing the coal, iron, salt, and timber resources at the Three Forks, Stealey advised investors: "There they exist entombed and locked up in nature's great coffers, and it only remains for your intelligence, energy, and enterprise, to forge the key to unlock them, and let their hoarded treasures flow forth to recompense our labor, remunerate our capital, and to increase our domestic wealth, our comforts, and our social intercourse." Although Stealey continued promoting Three Forks real estate and the slackwater project throughout the 1850s, the Kentucky River Navigation Company never found the wherewithal needed to start construction.³³

Kentucky River Navigation.

The attention of the members of the legislature is called to the very able report of Geo. Steally, Esq., Civil Engineer, to the Kentucky River Navigation Company.-- This report was made in 1858 and we publish it to-day at the request of friends of the measure now before the Legislature, that that body may see the great importance of the work proposed by the Company seeking incorporation. What has already been done towards rendering the Kentucky river navigable, has been highly beneficial to the State. But the improvements have not gone far enough. The river passes through the most fertile portion of the State, through tobacco, hemp, and grain growing countries, and through regions abounding in iron, coal, salt and lumber. A fat part of this wealth, especially of coal, iron, and salt remains, as the report says, "entombed and locked up in nature's great coffers." The difficulty, the impossibility almost of its removal and finding a market after its mining and manufacture, forbids all enterprise in that direction. The fifteen counties immediately affected by the proposed charters constitute about one-ninth of the whole area of the State, and pay into the treasury one-fifth of the whole revenue. They contain too, one-seventh of the legal voters. From all this it seems that the interests of the State require the proposed improvement of navigation. The addition to the wealth and prosperity of the entire State from the sources above mentioned is almost beyond computation, and yet it depends greatly upon the means of transportation which are now being sought. Now, more than ever, there is a necessity for developing the resources of our State--- for encouraging a spirit of enterprise and lending every aid to its success. The Legislature should give earnest attention to this matter, and lend the assistance sought for. Thus will the treasures of the State--- as Mr. Steally says --- "flow forth to recompense our labor, remunerate our capital, and to increase our domestic wealth, our comforts, and our social intercourse."

Engineer George Stealey in 1858 urged extending the Kentucky's locks and dams farther upriver. (From *Frankfort Commonwealth*, Feb. 14, 1865.)

Although legislative efforts to abolish the Board of Internal Improvement proved abortive, in accordance with the 1850 Constitution the President of the Board became an elective office. In a spirited state-wide race of 1851, Whig candidate David Rice Haggard defeated the Democrat Joseph Thompson, to become the new president. Haggard appointed former Board secretary Austin Cox as the second Board member, and the state auditor Thomas Page became an *ex officio* member.³⁴

The son of a famed minister of the same name, Dr. David Rice Haggard practiced medicine in Burkesville and had represented Cumberland and Clinton counties in the legislature since 1844, serving on the House committee on internal improvements. Described as the most handsome, urbane gentleman in Kentucky, Dr. Haggard had become a Whig party leader at a time when the party had begun to disintegrate. In the 1851 state elections, the Whig candidate for governor lost the race to Democrat Lazarus Powell.³⁵

Taking office during the low-water construction season of 1851, Dr. Haggard continued the repairs begun by J. Speed Smith. He ordered more tons of rock dumped into Dam No. 1 and warned that repairs there would cost treble those at other dams because each year the heavy timbers passed over it and rebounded against the timbers of the dam for days, damaging the dam. He put the dredge *Slackwater* to work cutting a clear channel through Clay Lick bar, long an obstruction to navigation near Gratz, and replaced the timber and stone washed out at the upriver dams. Major repairs were required at Dam No. 4, where a hole had opened under the dam large enough to roll a hogshead through. Haggard had this hole plugged with large stones, the spaces between the large stones filled with smaller stone beaten to pieces, and layers of straw and hay dropped atop the stone filling.³⁶

Like Cates and Smith, Dr. Haggard feared the Frankfort to Louisville Railroad completed in 1851 might drive river commerce to ruin. Compared to steamboat travel on the rivers, the railroad shortened the distance between the cities by sixty-three miles and traveling time by sixteen hours. To compete with the railroad, Dr. Haggard further reduced the lockage tolls, specifically on barreled whiskey. He predicted that unless the slackwater project were extended to the Three Forks, the entire Kentucky River project might eventually fail, and, time and again, he urged the state legislature to approve a voter referendum on funding the project extension.³⁷



Kentucky River dams often developed leaks and required constant maintenance.

Dr. Haggard adopted many expedients to slash project maintenance expenses. In 1853 he suspended contracting for replacement lockgates, instead purchasing timber and iron and building them with hired labor, saving fifty percent over previous contract costs. Observing that the lockgates' upper sections deteriorated quickly because they were exposed to air, and noting that the downstream lockgates were ten to twelve feet longer than the upstream gates at each lock, Haggard ordered top sections of the downstream lockgates sawed off. Refitted, the bottom sections of the downstream gates then became replacements for the upstream lockgates.³⁸

Through maintenance cost reductions, Haggard thought the Board might, if permitted by the legislature, within ten years accumulate sufficient net profit from tolls to build Lock and Dam No. 6, thereby affording slackwater navigation farther upriver to Shaker Ferry. Like his predecessors, he advised the legislature of the need for extending slackwater to help market the resources at the Three Forks. Instead of using imported coal and salt from the Monongahela and Kanawha rivers, a completed slackwater project might allow Kentucky's farmers to live in cottages built from the Commonwealth's lumber, warm their homes with coal from Kentucky mountains, and till their fields with plows made of Red River iron. Among all states of the Union, Haggard lamented, Kentucky stood "first in the councils of the nation, first in war, fifth in wealth, and last in the advancement of her mineral, commercial and physical resources—the unerring highways to wealth and happiness."³⁹

Haggard's parsimonious management of the Kentucky River project impressed the House committee monitoring the Board of Internal Improvement. The committee reported that when Haggard became president in 1851 "it was confidently asserted and believed that the Kentucky River would be so injured in its business operations by the extension of the railroad from Frankfort to Louisville that it would fail." Haggard's management during the early 1850s slashed maintenance expenditures on the Kentucky from a \$16,000 annual average before he took office down to a \$9,000 average. As a result, the project during the early 1850s returned as much as \$17,000 annually in toll revenues to the state treasury. The House committee therefore recommended that Haggard be rewarded with a \$300 bonus supplementing his \$1,000 yearly salary.⁴⁰

Haggard's budget surpluses ended abruptly in 1854 when a flood swept down the Kentucky, generating such powerful currents that it emptied across the Ohio River and spent its force against the Indiana bank. "The only wonder seemed to be," Haggard said of the flood damages, "with those who witnessed the action of the river at Lock No. 1, was that a stick of timber was found in the dam in its original position."⁴¹

The 1854 flood wrecked Lock and Dam No. 1, emptying its timbercribs of stone again and destroying its lockgates. Because Haggard's stringent fiscal management had left no spare lockgates at hand, he dispatched Captain Samuel Steele and a team of lockgate builders to Lock No. 1 with a flatboat load of tools and replacement ironwork. The builders found no seasoned timber to build replacement lockgates, however, and they had to cut trees and saw the timbers before framing the new gates. This delayed the resumption of river commerce for several weeks, reducing toll revenues and largely increasing the repair costs. To repair other damages done by the 1854 flood, Haggard purchased 5,000 perches of stone to replace that washed out of the dams and 65,000 feet of oak plank to replace the decking torn from the dams.⁴²

To reduce future damages from rotting of the wooden lockgates, Haggard initiated experiments with different wood preservatives. He found painting the wooden gates with white lead paint ineffectual and other efforts at coating the wood also failed. He learned, however, that coal tar made an excellent preservative because it penetrated into "solid seasoned oak as thoroughly as the sap juice is wont to do in

Frankfort, January 1, 1861

RATES OF TOLL,

To be Collected from all Steamboats, Keel-Boats, Flat-Boats, Rafts, and other Crafts Carrying Freights, on the Kentucky River Navigation, from and after the 1st day of January, 1861

Ascending Freight, per mile, per hundred,	- - - - -	1-2 mill.
Descending Freight, per mile, per hundred,	- - - - -	1-2 mill.
Cabin Passengers, over 12 years old, per mile,	- - - - -	5 mills.
Children, Servants, and Dockers, per mile,	- - - - -	3 mills.
Horse, Mule, Jack, Jenny, or Cattle, per mile,	- - - - -	5 mills.
Hogs or Sheep, per mile,	- - - - -	2 mills.
Beef, Pork, and Lard, per barrel, per mile,	- - - - -	2 mills.
All kinds of Liquor, per barrel, per mile,	- - - - -	3 mills.
All Dry Barrels, per mile,	- - - - -	1½ mills.
Salt, Salt Fish, and other Wet Barrels, per mile,	- - - - -	1½ mills.
Lard, per keg, per mile,	- - - - -	1-3 mill.
Sacks of Corn or Wheat, of 2½ bushels, per mile,	- - - - -	1-2 mill.

Household and Kitchen Furniture, Farming Utensils, and goods shipped by the lot, other than articles herein enumerated, six per cent, upon charge for transportation, when ascending, and four per cent, when descending, per lock.

Tobacco, per hogshead, for passing No. 1, 30 cents; No. 2, 15 cents; No. 3, 10 cents; No. 4, 6 cents; No. 5, 4 cents.

Rafts of Timber, &c., 15 feet and under wide, 3 cents per lineal foot, per lock,

Rafts of Timber, over 15 feet and under 20 feet wide, 5 cents per lineal foot, per lock,

Rafts of Timber, 20 feet wide and under 30, 6 cents per lineal foot.

Rafts of Timber, 30 feet wide and under 36, 7 cents per lineal foot.

Small Skiffs passing lock, 50 cents each.

Lockage two dollars per lock, on Steamboats, loaded Flat-Boats, and Barges.

These rates of toll to be charged on Steamers to McConnell's Ferry, 95 miles; nothing from above that point.

Empty Flat-Boats, Keel-Boats, and Barges to pay 3 cents per lineal foot, per lock.

Flat-Boats, Keel-Boats, and Barges loaded with articles other than those above enumerated, to pay 6 cents per lineal foot, and two dollars lockage at each lock.

Flat-Boats, Keel-Boats, and rafts coming from above Brooklyn, to pay nothing.

J. P. BATES

FRANKFORT, January 1, 1861.

Pres't Board Internal Improvement.

DISTANCES ON KENTUCKY RIVER

Carrollton ----- Miles.	Six Mile ----- 31 Miles.	Frankfort ----- 66 Miles.
Frank's ----- 14 "	Savin ----- 37 "	Christopher's ----- 80 "
Marion ----- 17 "	Cedar ----- 41 "	Shryock's ----- 86 "
Drennon ----- 21 "	Flat Creek ----- 51 "	Wilson's ----- 90 "
Clay Lick ----- 29 "	Elkhorn ----- 54 "	McCoun's ----- 95 "

The special attention of Lock-Keepers and Steamboat Captains is called to the following law, which can be found in the 2d volume of Stanton's Revised Statutes of Kentucky, page 69:

SEC. 16. "Any steamboat that shall pass over a dam, without stopping and paying the collector the full toll; and any steam or other boat that shall pass through a lock without paying him full toll; and any boat whose officer shall render a false and fraudulent manifest, for the purpose of evading the payment of full toll, shall be liable for the sum of four hundred dollars for each offense, which may be enforced by attachment from the Circuit Court of the county where the toll is payable, or where the boat may be found. The master and owners, and the officer making such false manifest, shall also be jointly and severally, personally liable for such sum, to be recovered in such court. The process in either case may be served in any other county."

Kentucky River
toll rates in 1861.
(From Kentucky
State Archives.)

early Spring." In 1855 he reported the repairs he had completed and the new lockgate preservative left the project in more solid and substantial condition than it had been since completed in 1842. Annual project maintenance costs, he predicted, might amount to little more than a \$6,000 average in coming years.⁴³

By 1855 Haggard's strict reductions in project maintenance costs could no longer generate a net annual profit on the Kentucky River. The railroad from Frankfort to Louisville and connecting railroads rapidly building across the state became the preferred transportation mode for many commodities, severely eroding toll revenues on the Commonwealth's river projects and its turnpike roads as well. Reductions in toll revenues from the turnpike roads were so large that the turnpike companies and the state could no longer keep the roads in adequate repair, nor build more miles of roads. Yet, these challenges did not hamper Haggard during his 1855 race for reelection. With the Whig party dying, he joined the short-lived American (Know Nothing) Party in 1855 and the voters returned him to office for another four-year term.⁴⁴

During the late 1850s, Haggard's principal maintenance challenge developed at Dam No. 3, where a powerful eddy below the dam held floating logs and drift for hours. A pile of drift covering five acres accumulated at this spot, constantly ramming into the dam. "When you shall witness the action of the water at that point, it is beyond description," Haggard told the state legislature, adding: "You would be perfectly astonished to witness the action of the water at this dam."⁴⁵

In 1858 the backlash at Dam No. 3 drove logs upstream to ram repeatedly into the dam and shatter its timbercribs. When the river then swept stone from inside the timbercribs, the plank decking collapsed and half the dam breached. With insufficient toll revenues in reserve to pay for restoring Dam No. 3, Haggard, Captain Samuel Steele and state auditor Thomas Page borrowed funds from banks to pay for the emergency repairs, using the next year's toll revenues as collateral. Fortunately, toll receipts increased in 1859, allowing them to repay their debt for the repairs.⁴⁶

After 1854, annual Kentucky River project maintenance costs usually exceeded toll revenues, and the project's operation then continued only at a deficit. In some years when flood damages and repair costs were routine, the project produced small revenue surpluses, but in most years it became a drag on the state treasury. At the end of his second four-year term as Board president in 1859, Haggard warned of further increases in project maintenance costs as the structures deteriorated. These costs, he asserted "will never be again as small in any one year, perhaps as long as the State shall sustain this line."⁴⁷

Although the Kentucky River slackwater had prospered during the 1840s, serving regional transportation needs well under the management of Metcalfe, Cates, and Smith, only strenuous efforts by Haggard kept the project operational during the 1850s. The toll revenue reductions resulting from railroad competition together with increasing maintenance costs of the aging project inevitably produced budget deficits. This budgetary drain on the Commonwealth's general fund fostered legislative interest in transferring the project to a navigation company, especially to a company that promised to build more locks and dams on the river. Interest in corporate management of the project received additional impetus during the Civil War, when a lock was sabotaged and more of the Kentucky River dams collapsed.

Kentucky River

7

STRUGGLES ON THE KENTUCKY

The true greatness of a State consists in the intelligence of its people, regulated by the true principles of sobriety, industry and integrity and the full development of all its physical resources, which tends to gratify their social comforts; and wherever on this globe a people thus blessed can be found you will always find them ready and willing to aid in defending their country in war, and ready to pay the full demands of their country in time of peace.

David R. Haggard, 1858

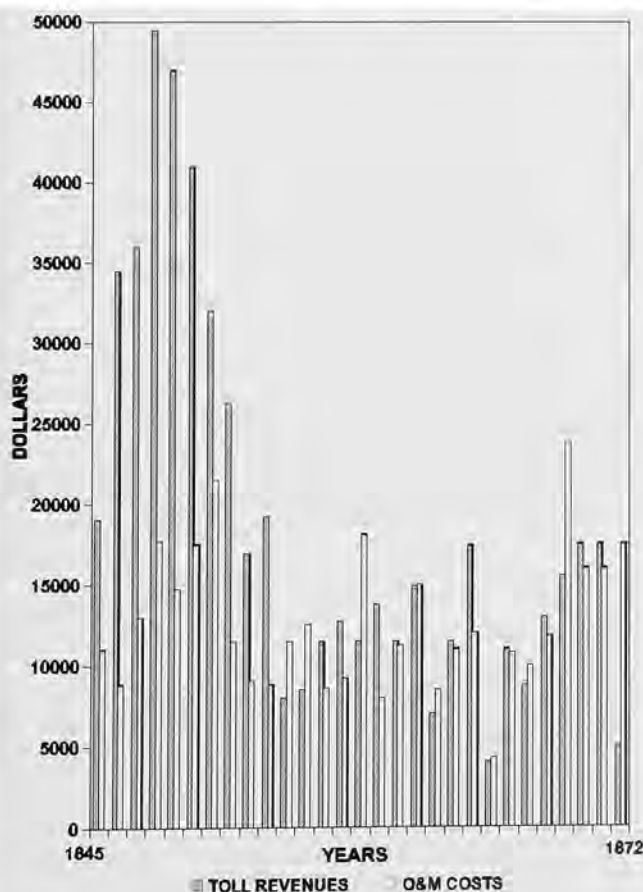
Although several railroads were building across the Commonwealth by 1860, the state's slackwater navigation and turnpike mileage were not expanding and indeed were deteriorating. During the decade preceding the Civil War, David R. Haggard and the Board of Internal Improvement had returned \$352,000 in dividends from the Commonwealth's transportation projects to the state treasury. James P. Bates, who succeeded Haggard as president of the Board in 1860, could never have matched this return, even if the Civil War had not disrupted his management of the system.¹

Kentucky's transportation system proved critical to the Union Army's advance south during the Civil War. On the turnpike roads, Union armies crisscrossed the state in pursuit of Confederate armies and raiders such as John Hunt Morgan and George M. Jessee. The state's slackwater projects, especially the Green River, became logistic lines, transporting supplies and reinforcements to Union armies and

fortifications. To delay the Union Army's advance and disrupt its logistics, Confederate raiders destroyed bridges on the turnpikes and railroads, harassed steamboat commerce, and sabotaged locks on the rivers.

Maintenance costs of the river project had nearly balanced against the revenues from toll collection before the Civil War. The Union Army and its suppliers claimed exemptions from the state tolls, however, and the resulting revenue reductions in combination with damages and delays from Confederate and guerrilla harassment and sabotage forced the Kentucky and Green River projects into deficit financing, and when the aging locks and dams gave way in 1864 the Board of Internal Improvement had no financial reserves for restoring the navigation. Forced to appropriate large sums from general revenues to pay for the repairs, the Commonwealth in 1865 decided to give its slackwater projects to privately owned navigation companies. Corporate management on the Kentucky River, however, proved no more efficient than the state's Board of Internal Improvement, leaving the improperly maintained locks and dams to the river's furious torrents.

* * * * *



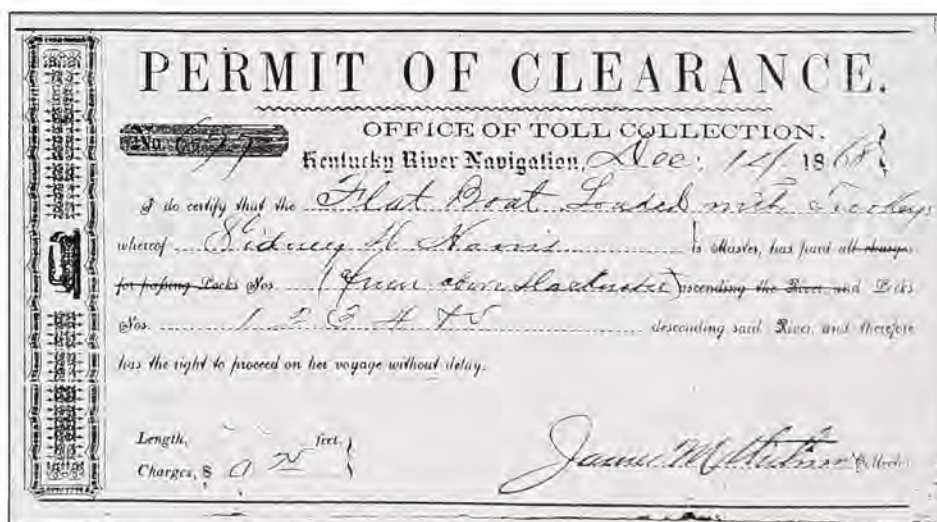
An attorney and postmaster from Glasgow, James P. Bates represented Barren County in the legislature for years before his election as Dr. David R. Haggard's replacement. While the Board of Internal Improvement always had at least one member representing the Commonwealth's Green River slackwater project, Bates was the first Board president from the state's southwestern sector and also the first Democrat to hold the office. In addition to challenges presented by the deteriorating Green and Kentucky River projects and fiscal shortages, President Bates confronted critical decisions on the eve of the Civil War.²

An unusual fiscal crisis developed as the result of defalcation by state auditor Thomas S. Page. Made a member of the Board of Internal Improvement by fiat in 1851 to systematically monitor its expenditures, Page served eight years before discovery that he had embezzled \$88,000. This sum would have maintained the Kentucky River project for eight years at prewar rates. When state government sued to recover its funds, however, Page declared bankruptcy and later died penniless in Frankfort.³

With a new state auditor serving on the Board, it reviewed conditions on the Kentucky River project in 1860, and James P. Bates became concerned. He found that Dr. Haggard had left the project \$2,000 in debt for repairs and back salary for the lock keepers, and he considered only a single lockgate at any of the five locks safe against imminent failure. In the autumn of 1860, Bates had six new lockgates installed and completed a major structural reinforcement of Dam No. 5. Bates also wanted to raise the height of Dam No. 1 by eighteen inches because it had settled, leaving a lower navigation pool with insufficient depth for boats to safely enter Lock No. 2. He lacked the funding for this modification, and, indeed, he ended the 1860 construction season with another \$2,500 in debt pledged against future toll revenues.⁴

The project repairs Bates planned for the low-water season in the autumn of 1861 were not undertaken because he sympathized with the Confederacy. When he went south with Kentucky's Confederate government to Bowling Green in 1861, taking project records with him, the loyal Union legislature at Frankfort abolished his office of Board president to regain full control of the Kentucky and Green rivers and other state transportation routes.⁵

In this emergency, the legislature reorganized the Board of Internal Improvement to consist of a chairman and two members, each paid only \$200 annually, and in a spirited election of December 1861 it chose three new, loyal Union members to the Board. As Board chairman, it elected Philip Swigert, the wealthy Frankfort businessman with financial interest in railroads, turnpike companies and steamboats navigating the Kentucky River. Other new members included John Todd of Frankfort, a relative of Mrs. Abraham Lincoln, and William Brown, a Green River contractor from Bowling Green.⁶



Permit of Dec. 14, 1868, for a flatboat loaded with turkeys to pass through Kentucky River Locks, probably to become Christmas dinners in Louisville. (From Kentucky State Archives.)

The onset of war disrupted commerce on the Kentucky River as it did on other Ohio River tributaries leading toward the South. The steamboats *Bracelet* and *Pink Varble No. 2* left the Kentucky River trade, went south to become Confederate transports, and went to the bottom of the Mississippi River during the war. Becoming Union Army transports, the *Hazel Dell* took the Second Kentucky Regiment to war, and the *Charles Miller*, which had towed coal barges on the Kentucky, was lost on the Cumberland River while in the Union's service. This left only the packet *Blue Wing No. 2* commanded by Captain Samuel Sanders in regular service on the Kentucky in 1862.⁷

Chairman Philip Swigert and the Board selected George Cabbage to superintend Kentucky River project maintenance and William Franklin to collect the tolls at Frankfort. These accomplished little during 1862, because the combat theater moved north that year into Kentucky, and Frankfort became the only capital of a Union state captured by the Confederate Army during the war. Steamboat service from Louisville and Cincinnati to the Kentucky River nearly stalled while a Confederate state government occupied the capital in late 1862, and project toll revenues plummeted more than fifty percent, declining from the \$15,000 collected in 1861 to \$6,700 in 1862.⁸

Because Captain Samuel Sanders continued plying the Kentucky with *Blue Wing No. 2* during the Confederate occupation of Frankfort, it cost him his steamboat. After the Union victory at Perryville and the recapture of Frankfort, a Union gunboat confiscated the *Blue Wing No. 2* for trading with the Confederacy. The Union Quartermaster Corps converted the steamboat into a military transport for service on the Lower Mississippi River, where Confederates captured and burned it in December 1862.⁹

Philip Swigert and John Watson of Frankfort restored steamboat commerce on the Kentucky River in 1863 by funding construction of the steamboats *Wren* and *Blue Wing No. 3*. Captain Samuel Sanders braved occasional Confederate sniper fire while piloting the *Wren* from Louisville up the Kentucky River as far as Shaker Landing, taking out cargoes of preserves, seeds, and Shaker products. Captain John Holton and his son, "Commodore" Robert Holton piloted *Blue Wing No. 3* during its runs up the Kentucky to Frankfort and Shaker Landing, escaping Confederate raiders until 1864 when guerrillas commanded by Captain George Jessee stopped and boarded it above Lock No. 1. The Confederates searched the *Blue Wing No. 3* for guns or contraband, and, finding none, they ordered dinner, cigars, and bourbon served, then graciously allowed Captain Holton to proceed unharmed.¹⁰

Kentucky River revenues climbed in 1863 back to the prewar level and would have been greater had the Union Army paid tolls on the materials shipped to two posts it built on the river. Designed and built on a hill overlooking Frankfort by Quincy A. Gillmore and James H. Simpson of the Corps of Engineers in 1863, Fort Boone protected the capital against renewed Confederate assaults. Camp Nelson, established by General Ambrose Burnside in 1863 as Union Army of the Ohio headquarters, became a recruiting station and staging area for the Union Army's advance into East Tennessee. The extent these posts relied on supply by river is not evident because the Army claimed exemption of its shipments from state tolls.¹¹

The Board of Internal Improvement thought the Union Army should have paid tolls on its river shipments. Its chairman later explained that his lock keepers and toll collectors "were citizens, and not soldiers, and were not prepared to fight a steamboat, and especially when loaded with soldiers. My officers being very polite, bowed them through the locks." In 1863 the Kentucky legislature directed its congressional delegation to seek passage of an act reimbursing the state for use of projects to transport Union troops and stores, and it sent Philip Swigert to Washing-

ton to press the state's claims. The Army agreed only to paying half the tolls on turnpike roads and none at all for its use of the slackwater projects.¹²

By late 1863, leakage through Dam No. 3 had become so effusive that Philip Swigert and the Board ordered the dam raised by three feet. This additional height would compensate for the leakage and hold a pool deep enough to continue navigation up to Frankfort. This emergency repair created a three-foot fall onto the downstream timbercribs of the dam, however, and logs and drift dropping over this fall began to split the timbercribs apart leading toward a collapse that confronted Swigert's successor as Board chairman.¹³

The legislature in late 1863 returned the Board of Internal Improvement to its pre-war organization consisting of the state auditor plus a chairman and another member appointed by the governor. Governor Thomas Bramlette appointed William McNary to represent the Green River region and brought David R. Haggard, the Whig who had served as Board president from 1851 to 1859, back as the new Board chairman. After organizing the Fifth Kentucky Cavalry in Governor Bramlette's Union Army command, Haggard had led these troops until crippled by rheumatism in 1863. While he had served with his unit in Tennessee, Union forces camped on his Burkesville farm, consuming his cattle, burning his wood and fences, and destroying his home and barns. Returning to leadership of the Board on crutches and nearly penniless, Haggard was grateful for his appointment as Board chairman at \$1200 a year.¹⁴

Haggard brought Captain Samuel Steele back on the job as his Kentucky River Superintendent and they inspected the Kentucky and Green River slackwater projects in February 1864. The toll collection system at the projects was in complete disarray. When they were informed that boats were in the government service, the lock keepers passed the boats without charge and without listing their cargoes. Haggard feared that "individual enterprise availed itself of the loose manner in which business was conducted, and in many instances shipments were made up the river upon its own account, having but a small amount of produce on board belonging to the Government."¹⁵



Workers make repairs inside a Kentucky River lock.

During early 1864 traffic on both the Green and Kentucky rivers stalled. Green River Lock No. 2 fell over into the river, and Kentucky River Dam No. 3 breached in the middle, blocking river commerce at both points. Haggard and the Board had little reserve funding on hand, and they had difficulty employing labor for the repairs because workers had either been drafted by the Union Army or were driven off by Confederate guerrillas.¹⁶

Haggard employed George Stealey, the former project engineer who had become Louisville's city engineer, to examine the Kentucky River dams. Stealey found Dam Nos. 1, 2, 4, and 5 damaged but still serviceable. The fall of the river over Dam No. 3 had wrecked it from summit to base, however, opening a 120-foot breach through the dam and blocking the channel where the stone washed from the dam had formed a reef. To restore navigation through to Frankfort, this breach had to be closed, the lower slope of the dam raised, and the rock reef below the dam removed, and Stealey estimated these repairs would cost \$30,000.¹⁷

Haggard implored the legislature to appropriate funds for the repairs, declaring: "It is a line of not only State importance, but for the last three years it has been of vast national importance. The amount of transportation over this line has been very considerable, and at certain periods the supplies that were sent up this line could be obtained only upon the rich farms upon its borders." He proclaimed that both the Kentucky and Green rivers had contributed signally to the success of Union armies.¹⁷

With the few thousand dollars available from toll revenues, Haggard attempted the project repairs in late 1864, but Confederate raiders prevented his employing sufficient labor. "High wages were offered," Haggard reported, "but the guerrillas came in for their plunder in the vicinity of the improvements, and high wages were no inducement to meet the hazard of being conscripted and maltreated by those outlaws."¹⁸

Captain Sam Sanders with the *Wren* and Captain Israel Little with the *Blue Wing No. 3* continued their trade from Louisville by ascending the river as far as Lock No. 3 (Cedar Lock) opposite Monterey. There, they transshipped their cargo to small craft above the lock or sent it overland in wagons. This was accomplished in the face of sabotage and frequent brushes with roving Confederate bands, notably those led by Captain George Jessee of Henry County.¹⁹

Learning of Confederate plots to set fire to steamboats at Louisville and St. Louis, General William T. Sherman issued special orders for steamboat captains in 1864. "We cannot operate by military force against such devils, but we can shelter and protect steamboat captains who resort to extraordinary measures to guard the property and lives in their charge against such villains," Sherman told the officer commanding at Louisville: "You may notify them that if they detect among their passengers or crew one or more whom they know to be engaged in such a scheme that they should be disposed of summarily, viz., drowned or killed on the spot."²⁰

John Castleman of Lexington led a Confederate band planning steamboat sabotage at St. Louis and Louisville. After an attempt to burn boats at St. Louis, he and fellow arsonists were captured in Indiana before they reached Louisville and they were sentenced to execution. Thus, boats trading from Louisville to the Kentucky and other rivers escaped destruction. In 1864, however, Confederate raiders blocked Kentucky River navigation by sabotaging Lock No. 1 near Carrollton.²¹



View of the manually
operated lock mechanism
at Lock No. 1

After the Battle of Perryville in 1862, Captain George Jessee and his Sixth Confederate Battalion had remained in Kentucky with orders to disrupt Union logistics. Jessee had recruited his unit from Henry, Carroll, and Trimble counties along the lower Kentucky River, and he centered his guerrilla raids there on familiar terrain where he could elude Union pursuit. Reporting to Colonel J. Stoddard Johnston and General John C. Breckinridge in Virginia, Jessee constantly evaded the Union Army. He struck at railroads and bridges, terrorized Kentucky River steamboat crews and project workers, and took brief control of villages.²²

When Captain Jessee and his guerrillas attacked Ghent, Kentucky, in August 1864, artillery fire from across the Ohio River at Vevay drove them away. From Ghent, Jessee headed up the Kentucky River to Lock No. 1 and on August 29 he wrecked the lock's operating mechanisms and lockgates, causing enormous damages estimated at \$5,000. He and his troops were riding upriver toward Lock No. 2 when Union forces intercepted him at Springport (Inverness). Urging faster pursuit of Jessee's band, the Frankfort newspaper editor commented: "Many men have pulled hemp for less crimes than they are guilty of."²³

As the Civil War entered its final year, the Kentucky legislature again reviewed the future of its slackwater projects. After appropriating \$30,000 to fund emergency repairs of the sabotage and breached dam on the Kentucky River, it studied recommendations by George Stealey that the state turn the project over to corporate management. "Now, more than ever," Stealey advised, "there is a necessity for developing the resources of our State—for encouraging a spirit of enterprise and lending every aid to its success."²⁴

In February 1865 the Kentucky House voted 60 to 14 to incorporate a new Kentucky River Navigation Company, and the company's charter passed the Senate without amendment and received Governor Bramlette's signature. Philip Swigert and Harry Todd of Frankfort, George Stealey of Louisville, Jeremiah Munday of Woodford County, Moreau Brown of Jessamine County, and John McGuire and Samuel Beatty of Beattyville became the company's directors. These had the authority to start work on the Kentucky River and take control of its locks and dams as soon as they had obtained \$200,000 in capital stock subscriptions. The state charter authorized county governments bordering the river to use tax revenues as investments in company stock, and the company's directors in 1865 lobbied for the counties to make the investments. George Stealey optimistically forecast that these investments in the river would not only prove profitable, "the beneficial results of its effects on the value of property, and increase of agricultural productions, manufactures, and trade, will amply remunerate the counties immediately and directly interested in the completion of the work."²⁵

While the Kentucky River Navigation Company organized and sought the investments, Haggard and Samuel Steele initiated the project restoration funded by state appropriations. They repaired the sabotage at Lock No. 1, reconstructed Dam No. 3, and contracted with the Louisville and Portland Canal to loan its dredge *Sampton* to remove the rocky shoal obstructing the channel below Dam No. 3. This completed, in October 1865 Haggard and Steele reopened the Kentucky River slackwater, passing boats up to Frankfort and beyond.²⁶

At the end of 1865, Haggard reported the emergency repairs completed at total costs of \$39,000. He had ordered "every stick of defective timber that could be reached removed; and every pen that was partly emptied filled, and every crib repaired with a thorough set of sound gates, ready to be put into place where they will soon be needed." Along with the Kentucky, he also restored navigation on the Green River project in 1865, and he declared both projects well worth the expenditures. "Both lines have fully illustrated the great advantage of each during the late war," he asserted, adding: "They have been the two great thoroughfares for the supplies of both armies—the Confederate army before the blockage, and the Federal army afterwards."²⁷

Although his critics complained of the high repair costs, Haggard responded the projects were wrecked by the war's end and without the major repairs neither would have carried steamboat commerce during the postwar years. To complaints that the pay of Board members and the lock keepers were too high, Haggard replied that, unlike former chairman Philip Swigert, he was not wealthy and could not serve for \$200 a year, and the lock keepers had to be gentlemen of judgment, "quick to conceive and prompt in execution—and a man of thorough knowledge of the structure of the works—a man of mechanical mind, who knows how to work, and what a man can do in a given time, and what certain labor is worth." Perhaps he and the Board could employ lock keepers for less than \$250 a year, Haggard admitted, but mistakes during lockage would destroy the lockgates and threaten loss of steamboats and their passengers, making the state liable for damages in addition to repair costs. The state's lock keepers, Haggard argued, must be the most competent workers, not persons who might work for the least pay.²⁸

To help recover the rising maintenance costs, Haggard substantially increased tolls on Kentucky River commerce. Noting that his predecessor, Philip Swigert, had increased tolls on the Green River project but not on the Kentucky River, Haggard saw no logic in this and raised the Kentucky River tolls to match the higher Green River toll rates. This toll increase and Haggard's criticism of Swigert's experiments with raising the heights of dams put these two leaders at loggerheads. Swigert soon questioned the Board's organization and activities under Haggard's management.²⁹

Although higher rates kept total toll revenue steady on the Kentucky during postwar years, river commerce was in transition. After the Union Army destroyed the Goose Creek saltworks during the war, saltboat traffic from South Fork down the Kentucky to Frankfort dwindled, replaced by salt from the Kanawha River in West Virginia that boated upriver to Frankfort and absorbed the market. Occasional shipments of Red River Iron in "ironboats" still descended the Kentucky from Miller's Creek to market, and in 1867 two ironboats blocked Lock No. 4 when their crews tied there for a night's sleep, and a sudden river rise sank their boats before they knew it was happening. Ironboat traffic steadily dwindled during postwar years, however, until 1886 when the last load of Red River pig iron floated down the Kentucky. New iron-making processes had made the Red River charcoal furnaces obsolete.³⁰

Although coalboats from the Three Forks continued their annual winter voyages down the Kentucky to markets, Frankfort and Lexington in the postwar years received most of their coal from mines along the Monongahela River near Pittsburgh. Towboats pushed Monongahela coal in fleets of barges to Cincinnati, from whence smaller towboats transported it up the Kentucky River. This development disturbed Haggard who commented that the Commonwealth had superior coal at the Three Forks that could seldom get to Frankfort because neither the slackwater project nor railroads had been completed upriver into the coal mining region. "What a commentary on Kentucky economy!" he lamented.³¹

Haggard and Steele took advantage of extreme low-water in late 1867 to replace the miter sills—timbers the lockgates sealed against—in all the lock chambers, an expensive repair that required pumping the lock chambers dry. They also had the sunken ironboats blocking the entrance to Lock No. 4 removed, and they contracted with the dredge *Sampson* to excavate stone from the channel and place it as fill in Dam No. 3. This costly maintenance exceeded project revenues, causing another deficit, and forcing Haggard to return to the legislature and ask a supplemental \$5,000 appropriation. Although it granted the requested funds, the legislature recognized the project had become a continuing drain on the state budget, and it considered the early transfer of both the Kentucky and the Green River projects to corporate navigation companies.³²

In addition, Philip Swigert in 1867 arranged a thorough audit of the Board's accounts by John Mason Brown. Brown's analysis proved highly critical of the "loose and unbusiness-like" conduct of fiscal affairs on the Kentucky, especially of the oral contracts made for labor and materials and the travel expenses paid to Haggard and Superintendent Steele. Brown alleged that no law provided for the appointment of a project superintendent and he even rejected Steele's livery stable bills. In total, Brown questioned the legality of the Board's payments since 1864 on \$35,000 worth of bills.³³

Pointing out the Board had employed superintendents since the project was built, Haggard called Brown's report "preposterous." If superintendents were needed when the project was new, he asked, "how much more necessary is it now when the works are old, and a large portion of the timber has commenced decaying?" During the repair seasons, Superintendent Steele rode horseback from lock to lock to inspect the work, and Haggard had agreed to pay his livery stable costs. Haggard asserted the Board could employ no superintendents at \$600 a year, if they were forced to spend half their pay on travel expenses, and Haggard pronounced Steele's services vital to project management because he understood the work "from basement to comb-stick, from hollow coin to king-post, from cross-ties to range-timbers, from upper to lower breast-walls, abutments, and sluice-gates, from flooring of lock-chamber to coping, from wickets to levers."³⁴

Haggard challenged Brown's audit in the state legislature, pointing out that he and Steele during emergencies had borrowed money for project repairs on their own credit for subsequent repayment from toll revenues. If this had not been done, "instead of having boats and floats of every tonnage plying those rivers, carrying from the Ohio to the interior of the State the commerce of every county, and shipping the surplus of our own produce, you would see sadness depicted in every countenance, and ruin crouching upon every homestead."³⁵

Steele resigned as Superintendent, and Captain Thomas Cogar, another famous Kentucky River steamboat captain, replaced him, but Haggard pressed his case with the legislature and found vindication. The House committee reviewing the audit agreed with Haggard that oral contracts for materials and labor were sometimes needed in emergencies, that project superintendents were lawfully employed,

and that travel expenses of the superintendents and Board members were legitimate project costs. The committee also remarked that the United States government owed Kentucky more than \$50,000 in tolls for Union Army use of state slackwater projects, which if ever paid, would reimburse the postwar repairs to the damaged projects.³⁶

As his four-year term as Board chairman closed in early 1868, Haggard reviewed his twelve-years total service as project manager. Noting critics considered the Kentucky and Green River projects worthless because they paid few dividends to the treasury, Haggard observed that real estate bordering the Kentucky River slackwater had a value 500 percent greater than it had in 1842, and he asserted that the projects "have long since more than paid for themselves in the enhancement of real estate."³⁷

Haggard lamented that the Kentucky River project had never been completed to the Three Forks as planned and that the coal, mineral, and timber resources of the mountains remained undeveloped. He mentioned that although Kentucky had neglected these resources, they had not escaped the attention of non-residents in the North. "The keen-eyed Yankees," Haggard said, "are to be the population that will grow rich by spending their money in those great coal, salt, and lumber regions."³⁸

On leaving the Board, Haggard advised that he approved of leasing the state's river projects to private navigation companies, and he joined in the formation of a company to take control of the Green River project. In 1868 Haggard went home to Burkesville in Cumberland County, which in 1871 elected him to the state senate. To preside over dissolution of the Board, Governor John Stevenson selected Dr. Addison Thompson of Mercer County as Haggard's successor. When the Board closed its Frankfort office and the Kentucky River accounts at the end of 1868, including back pay due to Captain Steele and the lock keepers, it had an accumulated \$13,308 in debt that the legislature had to pay through an appropriation from general revenues.³⁹

Eager to transfer the Kentucky River project, along with its drain on general revenues, to the Kentucky River Navigation Company, the legislature encouraged the company's organization. Gradually, counties bordering the upper river which would benefit from project extension approved investments totaling more than \$600,000 in the company's stock. With Moreau Brown of Jessamine County as its president and Philip Swigert as its treasurer, the company began work on the Kentucky in 1869. Its charter required that before taking control of the five state locks and dams it had to place Locks and Dams Nos. 6 and 7 under construction, and it contracted with Bissett & McMahon to build those projects. With this requirement met, Governor John Stevenson in 1869 turned the Commonwealth's locks and dams on the Kentucky over to the company, giving it a fifty-year lease requiring annual rental payments to the state of \$1,500.⁴⁰

Company president Moreau Brown employed John Watson as toll collector at Frankfort and Clement Smith as project engineer, paying them \$500 annual salary and paying the lock keepers \$300 a year. Brown and the company's directors received no salaries. During its first eighteen months, the company's income consisted of \$35,000 in toll collections, \$10,000 borrowed from the state sinking fund, and \$18,918 invested by Jessamine County. Of the \$600,000 investment promised by county governments, the small sum from Jessamine County was all the company ever received, and even Jessamine County sued for the return of its funds. The company obtained its \$10,000 loan from the state sinking fund thanks to Philip Swigert, who deposited Frankfort city bonds as the loan's collateral.⁴¹

Company expenses during the same eighteen months consisted of \$4,812 in pay for lock keepers and staff, \$26,725 for maintaining the locks and dams, \$22,000 for starting construction of Locks and Dams Nos. 6 and 7, and \$6,000 payments on its sinking fund loan. When J. J. Bullitt of Louisville replaced Moreau Brown as company president in May 1872, the company still owed \$4,000 on its sinking fund loan, faced heavy expenditures for project repairs, and owed the Commonwealth \$4,000 in back rent on its lease.⁴²

Company president J. J. Bullitt loaned the navigation company \$12,000 to keep it solvent and the project operational until 1873 when he appealed to the legislature for assistance. Pointing out that the company needed to raise \$38,000 for major project maintenance, he asked the legislature to forgive the \$4,000 rental arrears the company owed the state, to forego future revenues from the lease, and to provide at least part of the \$38,000 needed for project repairs. Although Bullitt's request received vigorous support from State Senator David R. Haggard, it failed of enactment in the Senate by an 18 to 12 vote.⁴³

Without state assistance, without additional funding from county governments, the effort at corporate management of the Kentucky River slackwater project floundered. Toll revenues proved entirely inadequate for project maintenance, and without maintenance the dams began to collapse. The Governor therefore initiated litigation to annul the navigation company's lease of the Kentucky River locks and dams, and in 1876 courts returned the wrecked project to state control. One by one, the Kentucky River breached the timbercrib dams, and they became little more than obstacles to navigation.

During thirty years service from 1842 to 1872, the Kentucky River slackwater contributed substantially to the commercial and economic development of the Commonwealth and the nation. It had proven useful to the Union during the Civil War. But railroads diverted traffic from the state's transportation projects, eroding project revenues, and as a result of this reduction in combination with increasing maintenance required by the aging projects, the Kentucky River and other state projects operated only at a deficit. Corporate efforts to restore project profitability failed during the postwar era, and during the 1870s the future of the ruined project became a major policy issue for the Commonwealth.

Kentucky River



Deteriorated conditions at Dam No. 1 during the 1870's, with steamboat *United States* in the background.

8

THE DISASTROUS DEBUT

The full value of the system will not be demonstrated until navigation is extended to the Three Forks for the transportation of coal, iron, timber, and other products of the mountains.

J. Stoddard Johnston, 1887

As editor of Frankfort's *Yeoman* newspaper after the Civil War, Josiah Stoddard Johnston became a powerful advocate for building locks and dams to provide year-round navigation on the Kentucky River from its mouth to the Three Forks. Inspired by his understanding of geology and his close association with Nathaniel S. Shaler and John R. Procter of Kentucky's Geological Survey, Johnston firmly insisted that building more locks and dams on the Kentucky River would open its mountainous headwaters to economic transportation and development of its coal, mineral, and forest resources. Locks and dams on the river, moreover, would provide reliable market access for the Bluegrass region's agricultural produce and also permit development of water power for manufacturing. Thus, Johnston echoed the arguments of Kentucky's antebellum Whig party that the Commonwealth should develop and manufacture its own resources to become more self-sufficient.

A distinguished soldier, editor, and politician, Johnston was born in New Orleans in 1833, the son of a U.S. Senator and nephew of Confederate General Albert Sidney Johnston. Moving to Kentucky, he enrolled in the Western Military Institute at Georgetown and earned a law degree at Yale University in 1854. Entering the Confederate Army in 1861, he served on the staffs of Generals Braxton Bragg, John C. Breckinridge, and Simon Bolivar Buckner, rising to lieutenant colonel by war's end. At Frankfort after the war he became editor of the *Kentucky Yeoman*, where his good-humored editing made it sparkling reading from 1867 until it ceased publication in 1886.²

Colonel Johnston and his *Yeoman* became journalistic spokesmen for the Bourbon Democracy, the conservative wing of Kentucky's postwar Democratic party which made service with the Confederacy a qualification for political office. As chairman of the Democratic party's central committee, editor of its principal newspaper, and founder of the Kentucky Press Association, Johnston wielded great political power. He became Kentucky's Adjutant General in 1871, lost the 1875 gubernatorial nomination to James B. McCreary, and served as Governor McCreary's Secretary of State from 1875 to 1879.³

In Frankfort, Johnston and his newspaper displayed intense interest in the Kentucky River during the 1870s, reporting the occasional steamboat landings at Frankfort and the coalboat and lograft runs downriver from the Three Forks. The *Yeoman* regularly assessed the river's environmental conditions, describing the ice in winter, the spring floods, the best fishing spots in summer, and the green slime that made it unfit for swimming during droughts. As a founder and director of Frankfort's Boat Club, Colonel Johnston presided over annual rowing regattas along Frankfort's waterfront and presented blue pennants to the winners.⁴

Deterioration of the five locks and dams built on the lower Kentucky by the Commonwealth before the Civil War troubled Colonel Johnston and his *Yeoman*. Reviewing the project's history, Johnston summarized, "The maintenance of the

navigation became in time a burthen to the State, and at the close of the war, the system was practically worthless." By the late 1870s floods were breaching the dams, and when a flood breached Dam No. 5 in early 1878, Johnston and the *Yeoman* advised coal and lumber shippers to demolish the dam's remnants "to give passage to 50,000 saw logs, and a large number of boats of coal, destined for this city, on the first tides."⁵

As Secretary of State to Governor McCreary, Colonel Johnston worked closely with Nathaniel Shaler, a famous geologist and Harvard professor appointed in 1873 as the Commonwealth's geologist. Harvard and Yale in this case had mutual interest in Kentucky's history and geology and closeted together when Shaler returned to Frankfort from his wide-ranging geological explorations of the Commonwealth. Shaler's reports on coal in the Kentucky River's mountainous headwaters attracted the attention of mining companies, and in 1877 he and his assistant, John R. Proctor, urged that improving the river's navigation would encourage mining and manufacturing in Kentucky. They pointed out that more locks and dams built upstream of No. 5 would provide reliable transportation for the abundant Three Forks coal, and suggested that work should begin by building a movable dam at Beattyville. A movable dam might store water at night for release each day, creating artificial rises to float boats and rafts downstream to Frankfort.⁶

Shaler's reports stirred the enthusiasm of Colonel Johnston and others at Frankfort, and some backed their enthusiasm with investment. In their report, Shaler and Proctor argued that "a country which exports the raw material ends by exporting men, and that prosperity can never be enduring unless based upon productions." In 1878, they incorporated the Kentucky River Mills, which leased water power at Dam No. 4 in Frankfort to manufacture carpet backing and twine. By 1890, their mills employed a hundred workers manufacturing a quarter of the nation's hemp binding twine.⁷

When the Commonwealth in 1876 annulled the lease it had granted to the private navigation company, the proponents of repairing and extending the Kentucky River navigation conducted mass rallies at Frankfort, Beattyville, Louisville, and other communities to stir public interest. Colonel Johnston chaired some of these meetings, where Shaler's geological reports were distributed and read. When Franklin County Judge Lysander Hord became an avid project proponent, Johnston published serially in his *Yeoman* the papers in which Hord proposed to provide state prison inmates with useful employment repairing the locks and dams.⁸

To examine Kentucky River project conditions in 1877, Governor McCreary and Secretary of State Johnston employed Captain Robert H. Fitzhugh of Frankfort. Fitzhugh had served on General Robert E. Lee's staff as engineer officer, keeping railroads operational for logistical support of the Confederate Army. Moving to Kentucky after the war, Fitzhugh engaged in railroad engineering, promoting the development of Kentucky River valley resources together with the railroads needed to transport them to markets. Johnston published Fitzhugh's plans in the *Yeoman* and also promoted Fitzhugh's development of Lake Park, an amusement center at Frankfort complete with a lake, bandshell, and croquet and baseball fields. The editor of the *Yeoman* frankly considered Fitzhugh "one of the most competent practical engineers in this country."⁹

During his 1877 survey of the Kentucky's five locks and dams, Fitzhugh reported the stone masonry locks still serviceable after forty years, but the timbercrib dams either breached or rotted. He submitted four cost estimates to

Governor McCreary for restoring commercial navigation: repairing the existing dams would cost only \$71,402, building new wooden dams on the old foundations about \$145,000, building new wooden dams on new foundations about \$188,000, and building new stone masonry dams about \$300,000. In his annual message of January 1878, Governor McCreary relayed Fitzhugh's estimates to the General Assembly and endorsed legislation to restore the Kentucky's navigation because of "the resources it can be made to unlock, and the revenue it can be made to pay into the Treasury."¹⁰

Legislation for repairing the Kentucky River project, nevertheless, met vigorous opposition in the General Assembly. Its opponents countered the bills proposing aid for the Kentucky with bills or amendments for improving Tradewater River, Drakes Creek, and other streams outside the Bluegrass. Wrangling over these bills continued until the final raucous hours of the legislative session, when "a scene of the wildest excitement ensued," reported the *Yeoman*: "Ten or twenty members were on the floor at once, all demanding to be heard. Shouts and cries and laughter made day hideous, and the loud bangs of the Speaker's gavel, assisted by the energetic efforts of the Sergeant-at-Arms, failed to restore the slightest semblance of order."¹¹

In the end, the General Assembly declined to fund restoring the Kentucky's navigation and, instead, authorized counties bordering the river to fund it by issuing capital bonds, providing two-thirds of the county voters approved the necessary tax increases. The critical vote on the Kentucky River bond issue came in June 1878 in Franklin County, where Frankfort, the largest river port, stood to gain the most from restored navigation. Colonel Johnston and the *Yeoman* made their position bluntly clear: "Every man in this county who votes against the improvement of the Kentucky River, votes dead against his own interest."¹²

"The Dead River" was the *Yeoman's* headline announcing that Franklin County's tax referendum on the Kentucky had lost by eighty-seven votes. "The locks and dams will wash out," it predicted, "and we will go back to first principles, while other sections are pushing on the car of progress." Voted down in the Kentucky legislature, defeated in Franklin County, the Kentucky River project truly was defunct from the state and local perspective. Yet, there remained a national perspective.¹³

While the *Yeoman* and Bourbon Democracy had opposed Rutherford B. Hayes in the contested presidential election of 1876, Governor McCreary and Colonel Johnston were among the delegates welcoming the new President to Kentucky in April 1877. Hearing that Hayes had funding available for river projects, proponents of the Kentucky River petitioned the President for federal funding and urged their congressmen to obtain an appropriation. Their efforts succeeded in 1878 with enactment of a \$3,000 appropriation for a Kentucky River navigation survey by the U.S. Army Corps of Engineers.¹⁴

The Army's Chief of Engineers assigned the Kentucky River survey to the Corps' Cincinnati office commanded by Colonel William E. Merrill, who routinely employed civilian assistants for surveys and project engineering. At Frankfort in July 1878, Nathaniel Shaler met with Kentucky Congressmen Thomas Turner and Albert S. Berry to discuss the Corps survey, and they recommended that Merrill employ Captain Robert H. Fitzhugh of Frankfort for the task. Merrill instructed Captain Fitzhugh to begin the Corps survey at the point where he had ended the 1877 survey for Governor McCreary.¹⁵

In late 1878 Captain Fitzhugh examined the Kentucky River and its three forks nearly to their sources. Quoting passages from Shaler's geological reports, Fitzhugh submitted grandiose plans for building locks and dams the entire length of the Kentucky and long distances up its forks at a cost of \$4 million to rescue the basin's resources "from a state of uselessness and committed to the waiting hands of thousands who now endure the passage of involuntary idleness." Predicting the coal, salt, timber, and iron of Kentucky's mountains along with the hemp, tobacco, and produce of the Bluegrass would move to markets through locks and dams on the Kentucky, Fitzhugh declared it "supererogatory to enter into a detailed exhibit of the probable business to be developed by the proposed improvement, and especially so when the acknowledged productiveness of the counties involved is manifestly equal to the demands of any investment necessary to its relief from commercial thralldom." In case Congress would not provide the entire \$4 million, Fitzhugh estimated that repairing the five existing dams would cost \$84,802 and building new locks and dams to extend six-foot navigation to Beattyville would cost \$989,600, summing to a total of \$1,074,402 for the Kentucky's main stem.¹⁶

With Fitzhugh's report in hand, Judge Lysander Hord, a candidate for Congress, Nathaniel Shaler, and U. S. Senator-elect John Williams went to Washington to help Kentucky's delegation secure an appropriation for the Kentucky River. In March 1879, President Hayes signed a bill providing \$100,000 for repairing the five old state locks and dams on the Kentucky. "In our judgment, there should be no delay in prosecuting the work," editorialized the *Yeoman*: "It should be commenced at once, and pushed with vigor during the whole summer season." Repairs were delayed, however, until Kentucky in 1880 legally ceded its entire jurisdiction over the locks and dams, including their operation and maintenance, to the United States.¹⁷

To manage the Kentucky River project, the Chief of Engineers in April 1880 established a second Engineer District office at Cincinnati commanded by Captain James Cuyler. Fresh out of West Point in 1864, this young, handsome officer had participated in the mining crater assault on Petersburg during the siege of Richmond and held various Army assignments before appointed to direct work on the Kentucky. Learning that public sentiment in Kentucky was "very urgent and impatient that immediate work should be undertaken," Captain Cuyler agreed that an economic recession and coal famine at Frankfort resulting from the closed navigation justified public impatience. As his engineer in charge at Frankfort, he employed Captain Robert Fitzhugh to sound the river's depths, learn how badly the old state dams were broken, and determine how much timber and stone were needed for repairs. Cuyler planned to rush the dams' repairs during the 1880 low water season and sent his plans to the Chief of Engineers for review, receiving approval in merely four days.¹⁸

Captain Cuyler hoped to restore the four lowermost locks and dams during 1880 and thereby reopen navigation to Frankfort. The Commonwealth's masonry locks needed only a few stones reset, new gates and operating equipment installed, and their chambers and approach channels cleared. Except for Dam No. 4, however, the river had breached the dams, washing out 140 to 200 feet of their midsections, and the remnants still standing had rotted down to the waterline. Cuyler planned to tear out the old dams to the waterline and rebuild their top sections, preserving their original timbercrib design resembling log cabins filled with stone. Fearing Captain Fitzhugh had slightly underestimated the repair costs, he raised Fitzhugh's estimate of \$84,802 to \$100,000, which happened to be the amount appropriated by Congress. An additional \$35,000 would be required to repair Dam No. 5 above Frankfort, but its reconstruction could await further appropriations.¹⁹



View of Dam No. 5 showing the breach in the dam.

Rebuilding Dam No. 5 in 1885.



Because completing detailed surveys, preparing contract specifications, and advertising for contractors to do the work would have taken months, losing the 1880 working season, Cuyler decided to perform the repairs directly. Because he had not inherited a fully staffed and functioning organization, he started from nothing, purchasing construction equipment and materials, hiring workers and staff, and building temporary housing for workers adjacent to the dams. He assigned Captain Fitzhugh overall charge of construction and also made him personally responsible for the challenging repair job at Dam No. 1 near Carrollton.²⁰

After a two-month organizational phase, Cuyler began removing deteriorated sections of the dams in June 1880. He had one dam soaked in oil and put to the torch, but its timbers would not burn; he dismissed demolition because blasting would damage the foundation rock on which the dams would be rebuilt. There seemed no other alternative, so workers ripped the old dams apart piece by piece, a tedious process hampered by unusually high river stages lasting until August. Remaining optimistic, Cuyler filed his annual report in August and expressed hope that "the close of this working season will see the navigation of the river, practically suspended for the past six years, reinaugurated."²¹

Cuyler's hopes were blasted as workers tore into the old dams and he learned "they consisted merely of a mass of timbers of sizes from 20 inches diameter to 6 inches, thrown together without any system of framing or bolting, and either originally without stone filling, or what had been put in of this had been washed out, mostly by reason of the open and loose construction." Instead of ripping out the dams to the waterline and reconstructing only their tops as planned, Cuyler ordered them razed all the way to bedrock, forcing a nearly total reconstruction. He also encountered delays in driving piling to close gaps in the dams, because when Captain Fitzhugh completed his detailed surveys and soundings it became

apparent that the rushing river had scoured the riverbottom to depths of fifty feet. The final straw came when an early flood on the first of November forced Cuyler to suspend work for the winter without achieving what had been promised the people of Frankfort—reopening the locks by the end of the year.²²

“As a question of cost alone, the experience has amply demonstrated that it is cheaper to build a new dam, out and out, than to rebuild upon old ones,” Cuyler lamented, reflecting on the bitter lessons of 1880. Costs climbed to levels far greater than he expected because every part of each structure except the masonry lockwalls required replacement. Cuyler had assumed that the miter sills, the timbers in the lock chambers against which lockgates closed and sealed, having been continuously underwater, would not need replacement. Wrong again.²³

Cuyler resumed the reconstruction in the summer of 1881 and by the first of November all that remained to reopen navigation to Frankfort was hanging new wooden lockgates on the lockwalls and installing operating gear. But winter floods came early again in 1881 and with them came disaster at Dam No. 1. Broken stone had not yet been placed along the riverbank at the dam’s abutment to prevent erosion, and a sudden November flood cut into the banks, undermining the structure. When the abutment caved in, the Kentucky River rushed through the gap, soon scouring a new channel for itself around the dam. This “flanking” of the dam was a fiscal catastrophe because it forced the construction of a second dam across the new channel.²⁴

Cuyler rushed to the site and, blaming Fitzhugh for not protecting the dam’s flank, fired him and took personal charge in the emergency. Assembling all the workers and equipment he could obtain, Cuyler drove rows of timber piling (like telephone poles) across the new river channel, filled the area between the rows with trees, and dropped broken stone atop the trees, thereby blocking the new channel and turning the river back into its old channel, but at an additional cost of \$60,000.²⁵

By continuing work during winter when river stages permitted, Cuyler finished the repairs needed to reopen steamboat navigation to Frankfort in March 1882, and he used his construction labor and funding to operate and test the locks. River traffic resumed immediately, the *Hornet* and *City of Frankfort* inaugurating regular schedules, and by the last day of June, 128 lografts, 30 barges, and 52 flatboats had locked through, along with steamboat packets which passed through the locks 135 times.²⁶

Appropriated by Congress for construction, Cuyler’s project funding could not legally be used to pay lockmasters and maintenance costs except for testing, and Cuyler, moreover, had exhausted his construction funds. By virtue of the legislation authorizing the repairs, the locks and dams had become the property of the United States and the operations and maintenance costs had to be paid with federal, not state, funds. Cuyler therefore asked the Chief of Engineers either to allot him funds for operating the locks, or to allow him to collect tolls from the traffic as the Commonwealth had done earlier. Since the Corps of Engineers had never before operated a river lock and dam system, Congress had not established procedures for paying operating costs. By May 1882, Cuyler had spent every penny appropriated for construction and in

addition had outstanding debts he could not pay pending further appropriation. Since neither Congress nor the Chief of Engineers forwarded the funding for operations, Cuyler closed the Kentucky River locks and laid off the workers in early May. Such loud complaint followed that on May 20 the Chief of Engineers sent funds taken temporarily from another appropriation to pay the lockmasters so the Kentucky's commerce could resume.²⁷

Closing the Kentucky River locks in May 1882 won Cuyler no friends in Frankfort and complaints about his management grew louder throughout the year. Congressman John D. White, for example, bluntly told Secretary of War Robert Lincoln that Captain Fitzhugh clearly was a lunatic and Cuyler was incompetent. Having expended all funds and unable to pay outstanding bills amounting to \$6,000, Cuyler was in a bind. He could do no more work nor pay the bills until Congress made another appropriation, and this did not occur until August 1882. Creditors holding his unpaid bills met at the Franklin County Court House in early August and resolved that Secretary of War Lincoln should investigate Cuyler's mishandling of the Kentucky River project.²⁸

William Murray, a friend of the Todd family of Kentucky that included the mother of Secretary of War Robert Lincoln, led Frankfort's opposition to Cuyler. In a letter to the Secretary of War, Murray, while admitting that reopening river navigation had immediately reduced coal prices by half, claimed that Cuyler had squandered \$300,000 and two years on a job that should have been done with the initial \$100,000 appropriation in a single year. "The work speaks for itself," he said: "The money is out & the work not finished, the hands are not paid." Murray predicted that if Cuyler continued in charge the "coal fields of the mountains will never be reached in the next hundred years!"²⁹

The Chief of Engineers in October appointed three engineer officers led by Colonel William E. Merrill as investigators of the Kentucky River project. They examined Cuyler's papers at Cincinnati, then boated upriver for a public hearing at Frankfort on November 27, 1882. After hearing protests from William Murray, Judge Lysander Hord, and others, they interviewed personnel working on the project. The officers found the repair work satisfactorily done and Cuyler's accounts revealed no malfeasance. Yet, \$325,000 appropriated for the repairs had all been spent by May 1882, and a debt incurred; but little had been done toward reconstructing Dam No. 4 and nothing at all at No. 5. Cuyler's published estimates of the repair costs clearly had been misinformed, he had made unfortunate choices in hiring supervisory personnel, and he had published overly optimistic statements about when the river would reopen to Frankfort. "There is no doubt that they were intended to give correct information," commented the officers concerning the press releases, "though it would undoubtedly have been better if they had not been published, especially as many of the predictions as to the time of completion of the works proved erroneous."³⁰

The officers' report went to the Chief of Engineers in February 1883 at a time when a major flood inundated Frankfort, also damaging the recent repairs to the locks and dams. Suffering from "intense nervous depression," Cuyler returned home where his father, a retired Army surgeon, could care for him. His father lamented that his handsome son died on April 10, 1883, of "sudden exhaustion," a probable suicide.³¹

Captain Robert Fitzhugh's march toward the Three Forks ended with the flanking disaster at Dam No. 1 and he retired; Cuyler's march stopped at Lock and Dam No. 4 when the river ruined his career and made his life a torment. Colonel J. Stoddard Johnston, nevertheless, judged the renewed navigation to Frankfort a huge success. "The value of this improvement, and the restoration of navigation to the region of country through which the river runs, can not be overestimated," he declared, noting that river boat competition had forced railroads in the Bluegrass to reduce their rates by about half. He estimated the costs of restoring the navigation had been more than reimbursed by resulting savings to consumers at Frankfort, who could buy coal at half its earlier price.³²

"The full value of the system will not be demonstrated until navigation is extended to the Three Forks," Colonel Johnston proclaimed, "for the transportation of coal, iron, timber, and other products of the mountains." He predicted that when year-round navigation became available all the way to the Three Forks, Kentucky River coal would drive Pittsburgh coal from markets at Louisville and south. So "vast" seemed the benefits of extending the Kentucky River project upstream to the Three Forks that Johnston urged Kentucky's congressmen to vigorously hasten project construction.³³

The successors to Cuyler and Fitzhugh, Captain James C. Post and Assistant Engineer David L. Sublett, resumed the project repairs in 1883, reconstructing Locks and Dams Nos. 4 and 5. Their principal efforts were devoted by direction of Congress, however, to deep penetration of the territory, moving directly to the head of the Kentucky River, to the Three Forks at Beattyville.³⁴

Kentucky's State Geologist Nathaniel Shaler called for constructing a movable dam near the head of the Kentucky River. Probably inspired by the movable dams the Corps then was building on West Virginia's Kanawha River and on the Ohio River at Pittsburgh, Shaler thought a movable dam could store water several hours daily at Beattyville, then be dropped to release an artificial "tide" on which coalboats and lografts might splash downriver to Frankfort. Shaler might also have known of the "splash dams" used by Kentucky lumberjacks to flush logs down shallow creeks to deeper water for rafting. Whatever Shaler's inspiration, the movable dam concept interested Kentucky congressmen who served mountain constituents dependent for income on lografting and coalboating down the Kentucky.³⁵

Kentuckians had dug coal along the Three Forks since 1790, mining hillsides and loading coal in fragile wooden boats to float down the Kentucky on high "tides" to markets, but they suffered many losses. A hundred thousand bushels of coal were waiting in coalboats during January 1879, for instance, when a run of ice destroyed the boats and wasted the cargoes, worth perhaps \$10,000 at Frankfort. As a result, merchants investing in the coal could not pay their debts and purchase new stocks, and hands em-



View of the breached Dam No. 1 near Carrollton in 1883.

A timbercrib dam was constructed to close the breach around the abutment of Dam No. 1.



ployed in the mines and aboard the boats went without pay. The Frankfort newspaper observed that mountain businessmen would survive until spring in 1879 but families of the poor laborers would suffer. "In the name of reason and common sense and humanity and Christianity, how much longer," an editor asked, "will our State sit listless and indifferent to our cry for assistance, and refuse to lend us help in opening an avenue to market for our coal and iron and timber?"³⁶

Urged on by Kentucky's congressmen, the Chief of Engineers ordered an investigation of building a movable dam at Beattyville, and the Corps interviewed boatmen using the river. G. W. Daniel, riverman from Beattyville, thought a navigation lock at Beattyville would be useful only at low water, and then the coalboats could not venture down the 160 miles of obstructed channel between Beattyville and Frankfort. Lewis Harvie of Frankfort feared building a movable dam at Beattyville would divert funding from work on the lower river, would be costly because Beattyville then was forty-five miles from the nearest railroad, and would fail because swift torrents pouring out of the Three Forks would sweep logs and boulders into a movable dam and destroy it. The Corps reported that funding would be better spent on the lower river, but if a movable dam were to be built at Beattyville a detailed survey and study should begin.³⁷

When this report reached Washington, Congressman John D. White met personally with Brigadier General Horatio G. Wright, Chief of Engineers, and persuaded him that building a movable dam at Beattyville might be useful. The Chief told White that \$100,000 would be a good round figure to start the work, and White, though unable to secure the full amount, arranged a \$75,000 appropriation in the 1882 River and Harbor Act specifically for constructing a lock and movable dam at Beattyville.³⁸

After surveying the Beattyville site in 1883, Captain James C. Post, successor to Cuyler in charge of the Kentucky, reported that project design would be complex. Estimating a lock and movable dam would cost at least \$225,000 while a dam alone might cost \$100,000, Post recommended deferring lock construction until the locks and dams below Beattyville were completed, and he requested the appointment of a board of engineer officers to select a movable dam design best suited for conditions at Beattyville.³⁹

To conduct the Beattyville study, the Chief of Engineers appointed a board composed of Captain Post, Colonel William E. Merrill, and Lieutenant Colonel William P. Craighill, who were the Corps' experts on movable dam design. Merrill and Craighill had studied movable dams in Europe and had selected French Chanoine wicket dams for use on the Ohio and Kanawha rivers. The three Engineers rode horseback to Beattyville in November 1883 to see the dam's site and conduct a public hearing. They learned the yearly downstream commerce at Beattyville consisted of 650,000 bushels of coal worth \$81,250, six million board feet of sawlogs worth \$50,000, and 5,000 railroad crossties worth \$27,500, but this trade suffered severe losses when descending the Kentucky to market. Upstream commerce was conducted by crews of three to seven men pushing long poles against the riverbottom to force flatbottomed "pushboats" to Beattyville and above. Carrying feathers, ginseng, and country produce downstream, the pushboats returned with groceries, drygoods, and other merchandise, a trade vital to the Three Forks because rugged mountain roads could not support heavy wagons running to the nearest railroad terminal forty-five miles away.⁴⁰

The Corps officers explained at the public meeting that building a navigation lock would be costly, would require three years, and would be useless until locks and dams were completed on the river below Beattyville. When Lee County authorities agreed a lock seemed unnecessary, the officers decided to install an experimental movable dam. Because the French wickets used on the Ohio and Kanawha seemed unsuitable, the officers went to Pennsylvania to see movable dams on the Monongahela and Susquehanna rivers. These movable dams were called American beartraps because they had been invented in America rather than Europe and because they somewhat resembled the deadfall traps used by pioneers to catch wild game. They served to create artificial waves to float coalboats and lografts downriver to markets.⁴²

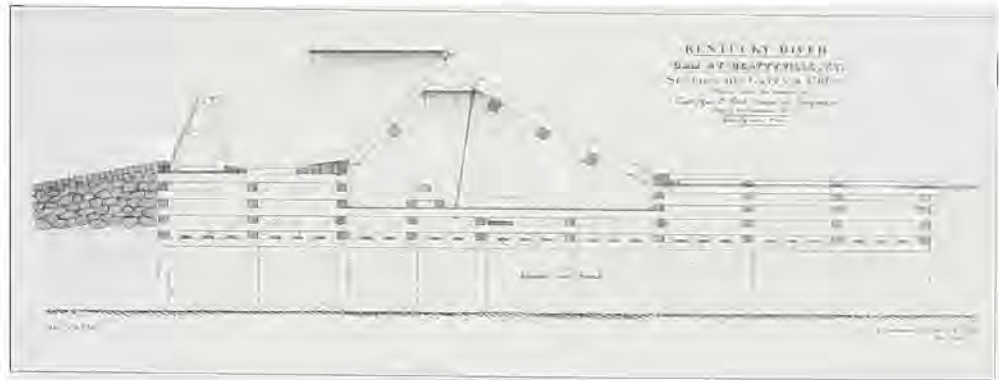
Placed in a chute or gap in a fixed dam, beartrap gates consisted of two rectangular panels, each hinged at one side to the foundation. The upstream leaf rested atop the downstream leaf and were so arranged that they could be raised by hydraulic action of the river. Opening a valve in the dam allowed water to pass beneath the two leaves, causing the leaves to rise and block the river's flow through the chute while a pool of water accumulated upstream of the dam. When boats were ready to float to market, closing the valve cut off flow beneath the beartrap leaves, which collapsed atop the foundation. This opened the chute and the accumulated water and boats flushed through the chute, gliding down a gentle slope to the channel below the dam and riding the artificial wave to their destinations. Beartraps were fabricated of wood, however, and their design was problematic: if they rose too fast under water pressure, they broke; or if one end rose faster than the other, they twisted and warped.⁴³

Since coalboats and sawlogs composed the chief commercial traffic at Beattyville, the officers recommended building an experimental beartrap dam there, leaving its difficult design to Captain Post who would modify it as construction proceeded. Captain Post planned building a stone-filled timber dam across the Kentucky River at Beattyville with two sixty-foot-wide beartrap gates blocking two adjoining and parallel chutes through the dam. Upstream guidewalls would direct boats into the chutes and over the beartraps. Downstream guidewalls would keep boats and rafts in the chutes as they dropped down the slope to the river below. The entire structure, consisting of a fourteen-foot high dam, the guidewalls and slopes, would be built of timber piling and wood-framing filled with broken stone.⁴⁴



The upstream entrance to the Beattyville beartrap chutes, still under construction in 1886.

1884 plans for the Beattyville beartrap dam showing the leaves in a raised position holding a pool. Water from the upstream pool passed through the culvert under the leaves and forced them to an upright position.



While Captain Post designed the beartraps and acquired land needed for the dam, the Kentucky Central Railroad bridged the river eighty miles below Beattyville at Ford, Kentucky. At the request of mountaineers, Captain Post sent workers to remove snags and obstructions from the river between the bridge and the dam site. Post then advertised for contractors to deliver timber, lumber, stone, and iron spikes to the Beattyville site. When contractors learned they would make delivery by pushing it up eighty miles of river, or by wagon over forty-five miles of mountain roads, they bid uniformly high; and one contractor backed out of his contract and paid the penalty rather than try it. Engineer R. S. Burnett, in local charge of building the beartraps, took the Corps snagboat *Kentucky* upriver at high water to inventory construction materials as they arrived and to employ artisans. Although attracting skilled labor to the isolated project proved difficult, Burnett managed to start construction in October 1885. By the summer of 1886, he had two hundred workers at the site, driving piling, building timber cribs, dumping stone into the dam and guidewalls, and framing the beartrap leaves.⁴⁵

It must have been an exciting time in Beattyville, for two hundred workmen at the dam constituted a substantial population increase. Investors arrived to purchase coal lands opened to navigation by the beartrap dam; three railroad companies began surveying tracks into the Beattyville area; and a Three Forks Investment Company formed. Congressman James B. McCreary, the former governor and ardent booster of Kentucky River navigation, joined with Louisville financiers in the Three Forks Investment Company to profit from Beattyville's boom, laying out a town addition and constructing commercial buildings for lease.⁴⁶

Building the beartrap-dam must have been a nightmare, with materials arriving whenever contractors could get them upriver or over the roads, with workmen hard to hold at the isolated work site, and floods coming every week out of one or more of the Three Forks. Engineer Burnett said he kept the work going night and day, though how he accomplished much at night without electric light is a mystery; yet, somehow he finagled to finish the movable dam in a single year.⁴⁷

Experimental operation of the dual beartraps, each sixty foot wide, began in October 1886, and they worked well, rising and lowering easily when valves opened and closed. But when the leaves lay flat against the foundation and the river poured through the chutes and down the slopes, the water reached an unexpectedly high velocity. At the bottom of the slopes, where water racing down the chutes met the river below, a chopping sea of waves formed. Raftsmen steering into the chutes often became frightened and jumped for their lives, leaving their rafts to ram broadside into the guidewalls and break apart or run wildly down the slope and smash in the waves below. Both rafts and coalboats that safely entered the chutes and descended the slopes were broken apart when they hit the turbulence at the bottom.⁴⁸

Soon after the beartraps opened to navigation, such as it was, Burnett noticed the wooden slopes starting to rise from unseen uplift pressures. To relieve the pressures, he bored holes through the floor and drove more sheet piling along the upstream side to cut off the river flow under the slopes. A November flood stopped this emergency work, however, and the slopes continued rising even though they were spiked into telephone-pole sized piles driven into the riverbed. So great was the uplift that it either pulled the spikes up through the length of the piles, or it lifted the floor and piles together as a unit. Once pressures lifted the slopes, backlash from the waves below began washing out the stone, eating its way upstream, tearing out guidewalls and slopes all the way back to the dam.⁴⁹

Though the dam itself still stood, damages were so severe that the Chief of Engineers recalled the officers who planned the experiment and sent them back to Beattyville. There, they saw that the slopes and guidewalls could be repaired, but turbulence at the bottom of the slopes would remain impassable for coalboats and rafts. Concluding that beartraps, as substitutes for navigation locks, would not work, the officers recommended replacing them with a stone masonry lock like those on the lower Kentucky. They urged contracting for the stone at once so it could be quarried in 1888 and lock construction could begin in 1889.⁵⁰

The Chief of Engineers sent Lieutenant William L. Sibert to Beattyville to repair the dam and construct the new lock. Sibert became one of America's foremost engineers, directing projects on the Green River at Bowling Green, on the Ohio at Louisville, and on the Panama Canal, and rising to high command during the First World War. Later, he had little to say about his Kentucky River project, and for good reason. He cut off the top of the Beattyville dam to allow lograft and coalboat passage at high water, dropped the material below the dam to check further erosion, and opened a quarry to cut limestone for use in the masonry navigation lock, but this work met a plague of troubles. In 1889, when Sibert built a timber cofferdam ringing the beartraps to raze them in preparation for laying the lockwall masonry, a hillside slipped down into the cofferdam and stopped the work. Five thousand barrels of cement for the lockwall mortar arrived aboard the steamboat *Ingomar* in 1889, and Sibert stored the cement in a shed built for the purpose on a hill near the dam. Although he carefully located the shed's floor four feet higher than the greatest flood ever recorded at the site, the cement was ruined by the flood of February 1890.⁵¹

A construction crew at a lock poses with family members in front.



Rebuilding Dam No. 4 at Frankfort in 1885.

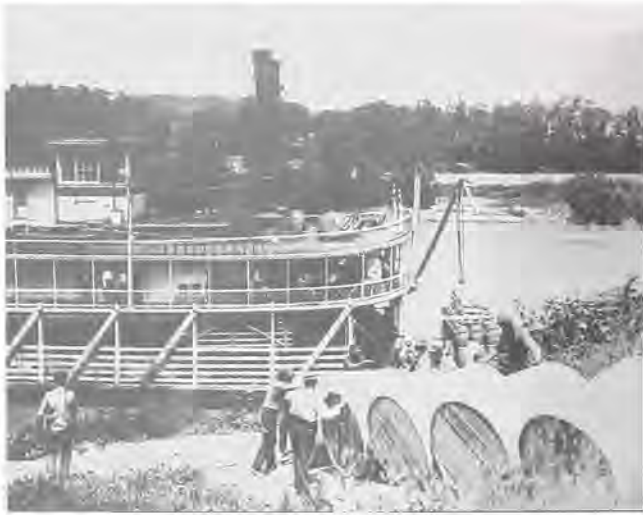
The Beattyville project's end seemed a farce, produced and directed by competing railroads. The Kentucky Union Railway, building into the coalfields at the time, had a bridge under construction across the North Fork six miles upstream of Beattyville when the February 1890 flood piled drift against the bridge and dammed the river; and when the flood washed out the bridge a wave swept Beattyville, submerging the town along with the Corps' cement stored so carefully in the shed. The "Riney-B" railroad was also building toward Beattyville at the time, coming upstream alongside the Kentucky River. Blasting space for tracks into the hillsides, the railroad's construction gang threw the rock into the river, entirely blocking low-water navigation into Beattyville. Complaints from the Corps got no results, because Congress had not yet enunciated the Corps' authority to protect rivers, and there were no protests from people at Beattyville because the railroad's advent meant they no longer had to bring their supplies upriver in pushboats.⁵²

Commenting that completing the navigation lock would be expensive and "its usefulness when completed less than it should be," the District Engineer recommended in late 1890 that the Corps surrender at Beattyville. With approval from the Chief of Engineers, construction of the Beattyville lock ceased in 1891 and the Corps shipped its equipment downriver to build Lock and Dam No. 6. When it tried to sell 5,000 barrels of wet cement, however, there were no takers. And disposal of Corps buildings at Beattyville proved unnecessary after a kerosene lamp exploded, setting the office afire, and high winds spread the flames to other buildings.⁵³

Because small steamboats operated on the short pool created by Beattyville Dam to the railroad six miles up the North Fork and short distances up the other forks, Beattyville officials asked in 1892 that the dam be raised to enhance steamboat navigation. This was not done because in 1893 the Kentucky Union completed a spur line into Beattyville from its bridge on the North Fork. The District Engineer then reported the Beattyville dam was no longer needed and in fact obstructed descending navigation by lografts. "In my opinion," he concluded, "it will not be advisable to expend any more money in maintaining this obstruction."⁵⁴

Engineers often learn more from their failures than from their successes, and thus it was with the Corps' disastrous debut on the Kentucky. After the Beattyville failure, the Corps redesigned beartraps, fabricating them of steel for use in regulating slackwater pools, not as substitutes for navigation locks. After its Kentucky River debacles, the Corps became chary of reconstructing old timbercrib dams, and officers who released overly optimistic public predictions risked their careers. For its Kentucky River challenges, the Corps recruited highly trained engineers, one being William McAlpine, graduate of the Massachusetts Institute of Technology, whose abilities were later memorialized in the McAlpine Locks and Dam at Louisville. These hard lessons served the Corps well as it continued its march up the Kentucky toward the Three Forks. In this process lasting until 1917, it completed nine locks and dams, Nos. 6 through 14, as funding from Congress permitted.

By the time all fourteen locks and dams entered service in 1917, the original project progenitors were gone. In retirement, Captain Robert Fitzhugh penned Robert E. Lee's biography and an amazing poetic tribute to coal. Nathaniel Shaler returned to Harvard as geology professor and dean and authored publications including a history of Kentucky before his death in 1906. When the *Yeoman* closed in 1886, Colonel J. Stoddard Johnston moved to Louisville as the *Courier-Journal's* associate editor and devoted much time to historical studies until his death in 1913, four years before his dream of canalizing the Kentucky



Steamboat *Falls City* loading tobacco hogsheads on the Kentucky. (From Hibben Collection, Kentucky Historical Society.)

River reached fruition. Of the project proponents in 1880, only Governor James B. McCreary survived to see it completed. Elected to Congress, he closely monitored Corps progress on the Kentucky River, but he retired before 1917 and took no apparent interest in the project's completion.⁵⁵

The Kentucky River navigation development was part of a broad federal initiative of the late nineteenth century to encourage national economic prosperity through transportation improvements, subsidizing railroad construction with land grants and funding river slackwater projects. Along with the Kentucky River, Congress acquired other state and private projects to free steamboat traffic from tolls and foster river competition with railroads; it accepted, as examples, the Muskingum River locks and dams from the State of Ohio in 1886, Kentucky's Green River locks and dams in 1888, and Pennsylvania's Monongahela River locks and dams in 1897. During the same era, Congress also funded navigation improvements on many other rivers—the Cumberland, Tennessee, Big Sandy, Kanawha, Little Kanawha, Wabash, and Allegheny were the largest in the Ohio River valley. Competing with the Kentucky River for construction funding from Congress, many of these steamboat navigation projects, like the Kentucky, were not completed before steamboat commerce languished.

Kentucky River

9

THE TIMBERCRIB PROJECT

The great reduction in the price of this important article of industry, and freights generally, caused by competition, has stimulated all branches of business and brought about a general reduction in the price of living.

David Sublett, 1885

The Corps' repairs of Dam No. 4 at Frankfort in October 1883 restored navigation on the Kentucky River to the state capital, finishing the federal project's first phase. Although the experimental Beattyville beartrap at Three Forks distracted attention and delayed work on the lower Kentucky, the Corps continued building its project on the river's central sector. Authorized by the Rivers and Harbors Act of 1879 to construct locks and dams providing slackwater on the entire course of the Kentucky from its mouth to Beattyville, the Corps, as congressional funding permitted, reconstructed Dam No. 5 in 1886 and completed Locks and Dams Nos. 6, 7, and 8 in upstream order in 1896, 1897, and 1900. Completed during the last twenty years of the nineteenth century, these structures had stone masonry locks and timbercrib dams like the state's project built before the Civil War. After 1900 concrete replaced stone and timber as the preferred material for lock and dam construction, and the Corps' timbercrib project on the Kentucky therefore represents the culmination of nineteenth century waterway engineering.



Workers standing on a Kentucky River dam abutment.

Like the Commonwealth before 1880, the Corps met significant maintenance and operations challenges on its timbercrib project. Having acquired full title to the locks and dams in 1880, with continual operational funding approved by Congress in 1884, the Corps built lockhouses, employed lockmasters, and established operating and regulatory procedures. To meet the annual maintenance requirements of a timbercrib project, the Corps acquired a fleet of workboats and established a depot at Frankfort. These operational and maintenance initiatives foreshadowed Corps procedures and policies of the twentieth century.

Now a largely forgotten technology, how waterways engineers built timbercrib dams should be recounted because, although long ago capped with concrete, the timbercrib dams built on the Kentucky River remained in service more than a century after their construction. Kentucky's pioneers had built timbercrib dams of logs to develop water power on small streams, but the Corps' timbercrib dams on the Kentucky River were made of ten-inch-square white oak or yellow pine timbers laid crosswise to form cribs or pens ten feet long and wide. Timbers laid parallel with the current were called "ties" and those placed perpendicular to the current were known as "stringers." When assembled, the timber cribs resembled log cabins, but at each corner iron driftbolts pinned the timbers together. The dam builders inserted iron bolts, with heads and wedge points, into holes drilled into the top timbers of a crib, and then drove them with sledgehammers through the timbers beneath. This formed a box-like pen to hold stone and form the dam.¹



Excavation at Lock No. 7 in 1895 was still done with shovels and wheelbarrels.

Building the timbercrib dam at No. 7, showing the stone-filled cribs before they were planked over.



Workers excavating the abutment of Dam No. 7, loading stone on skips for hoisting and removal from the pit.



Men shovel muck inside a cofferdam into skips for hoisting and removal while a steam pump in the background removes the water.

While workers assembled timbercribs in the shallows, a dredge removed sand and gravel from the axis of the dam extending from lockwall to abutment, if possible excavating all the overburden to expose the foundation bedrock. After an engineer sounded the riverbottom's contours along the dam axis, workers spiked wooden blocks to the bottom of the timbercribs to roughly match the bedrock's contours. The workers then guided the completed timbercribs as they floated downriver to their position in the dam's alignment. After workers and the dredge had filled a crib with stone, they placed another crib alongside the first to fill with stone, and continued placing more timbercribs in line across the river. After placing and filling the foundation cribs, the workers built more timber cribbing atop the bottom cribs and added more stone to raise the dam to its planned height.²



Floating timbercribs into place at a Kentucky River dam, 1906.

As the builders added the cribs one by one to the dam, the space through which the river flowed narrowed, increasing the current's depth and velocity at that point. To guide the last cribs into the gap, the workers attached ropes and wire cables to trees or other anchorages and played out the cables, allowing the cribs to float slowly downstream into position. This could be accomplished only at extreme low water, else the river's currents and depths would be too great.³

After timbercribs were in place and filled, manual or steam-powered floating piledrivers pounded three-inch thick oaken planks, called "sheetpiles," into the riverbottom along the dam's upstream face. The sheetpiles were driven as far into the riverbottom as possible (to refusal) to help prevent the river from flowing under the dam. The piledrivers then punched down another layer of planks along the dam's face, covering the spaces between the planks in the first layer to make the dam more watertight. To prevent the river from washing stone from inside the timbercribs, the workers roofed over or "capped" the top of the dam with decking planks spiked securely into the timbers.⁴

Kentucky River timbercrib dams were stepped, resembling a large staircase with treads ten feet wide and risers three feet and four inches high. While the height and width of the steps could vary, the builders carefully observed a ratio of three feet out for every one foot down because experience taught that if this ratio were not preserved the river at certain flows would shoot out over a step and damage the second step below. Building timbercrib dams was not a job for the faint hearted, there being several critical stages when work had to be done quickly and correctly the first time. Hesitation or indecision could be disastrous, and a craftsman who earned the title resident or assistant engineer on a timbercrib-dam project commanded respect.⁵

After the timbercribs were positioned and the piling driven, a dredge piled gravel and clay against the dam's upstream face to help prevent undermining, increase the dam's stability, and reduce the percolation (seepage) through the timbercribs. Large stones dropped along the dam's downstream toe protected it against erosion by the backlash (hydraulic jump) of the water coming over the dam. If unchecked, the backlash could work upstream beneath the dam and undermine it. Since the timbercribs merely boxed stone inside the pens and were not rigid, their builders expected them to settle. Timbercrib dams also bowed in their center toward downstream as the slackwater pool above them rose and increased pressures against the dam. One Kentucky River dam, for instance, bowed eighteen inches toward downstream at full pool, and this did not worry its builders.⁶

After the Corps repaired the four timbercrib dams downstream of Frankfort and reopened slackwater navigation in 1882, public pressure for speedy construction of the project abated. Urged by Congress to use contractors rather than hired labor for construction, the Corps decided to award (let) some of the work on the Kentucky to contractors, starting with a contract for building Dam No. 5. Learning from the troubles met by Captain Cuyler while rebuilding the old state dams Nos. 1 through 4, the Corps did not rebuild the old dam at No. 5, and instead contracted for building an entirely new dam a hundred feet downstream of the old dam. It opened five sealed, competitive bids for building Dam No. 5 in October 1884 and awarded the contract for \$66,505 to Israel V. Hoag, a construction expert formerly employed by the Corps on the Ohio River. Masterfully, Hoag built the new timbercrib dam in a single construction season, reopening Lock No. 5 for navigation on January 1, 1886. This restored the ninety-five miles of slackwater navigation formerly available on the old state project.⁷

Lock No. 5's deteriorated lockgates in 1885.



Commerce on the Kentucky River responded favorably to project restoration, rising from nearly nothing in 1880 to cargo valued at \$5.4 million in 1884. This commerce moved aboard two steam towboats and four passenger packets carrying passengers and tobacco hogsheads from Frankfort to Louisville for the same low fare: a dollar apiece. To compete with restored steamboat commerce, railroads serving Frankfort dropped their rates from an average of 33¢ down to 10¢ per each hundred pounds of freight, and as a collateral result the retail price of coal at Frankfort dropped from thirty-three cents per bushel down to fourteen cents a bushel. The 512,000 bushels of coal delivered to Frankfort in 1885 represented savings to consumers of \$66,000 in that year, and David Sublett, the Corps Assistant Engineer at Frankfort, declared: "The great reduction in the price of this important article of industry, and freights generally, caused by competition, has stimulated all branches of business and brought about a general reduction in the price of living."⁸



Timbercrib dam construction on the Kentucky River, 1885, at Lock No. 5.

Commercial traffic in coal, tobacco, grain, and whiskey on the Kentucky continued growing, climbing to \$10.8 million worth of commodities in 1887 and keeping eight packets—the *Lancaster*, *Hibernia*, *Grace Morris*, *Blue Wing*, *T. D. Dale*, *Hattie Brown*, *City of Clarksville*, and the *Ghent*—and six towboats—the *Excel*, *Alex. Montgomery*, *Al Martin*, *L. A. Fulton*, *W. B. Cole*, and *Hotspur*—at work moving the freight. Hopes for the success of the project rose, and the Corps' Assistant Engineer observed it had generated widespread benefits: "The people tributary to the river seem to have been stimulated to new life by these conditions, as is evident by the generally improved condition of the farms and farm-houses and the increased acreage under cultivation."⁹



The steamboat *Grace Morris* assists with the construction of a timbercrib dam.

Under these promising conditions, the Cincinnati District Engineer in 1887 submitted his plans for Lock and Dam No. 6, the first lock and dam on the Kentucky built entirely by the Corps, to the Chief of Engineers for approval. He proposed building a timbercrib dam and stone masonry lock at Finns Ripple, a mile downstream of Oregon, Kentucky, and estimated its cost at \$223,005. Recognizing that No. 6's design would establish the design pattern for upstream structures, the Chief convened a board of officers to review the plans. Colonels William E. Merrill of First Cincinnati District, Amos Stickney of Louisville District, and Orlando M. Poe, builder of the Poe Locks at Sault Ste. Marie, examined the plans for No. 6 at Cincinnati, traveled by steamboat to inspect the No. 6 site, and wrote their report at Frankfort in March 1887.¹⁰

The board of engineer officers approved the site selected for No. 6 and the timbercrib dam design but thought it wise to increase the lock's dimensions. Although this would increase project costs, it would nearly double lock capacity. They explained: "It is proposed to make the lock larger than those now constructed, about 10 feet longer and 14 feet wider, the length between hollow quoins being 185 feet and the width between chamber walls 52 feet. The increase of length is simply

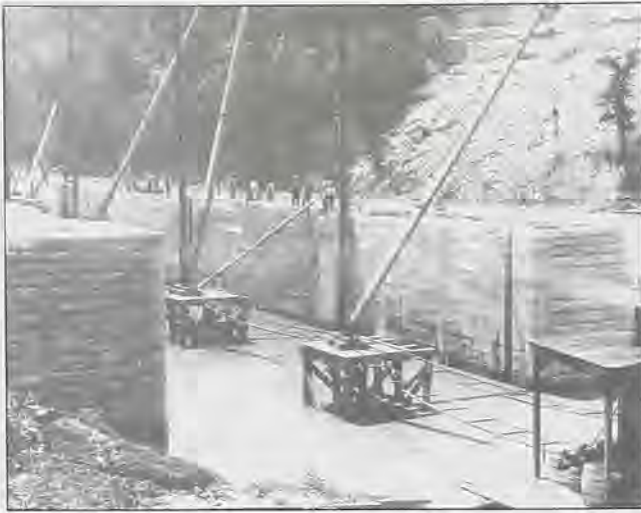
to provide for the increased size of gates, the available length for vessels remaining the same as in the old locks. The increase of width from 38 to 52 feet is intended to provide for the lockage of two coal barges of 25 feet abeam at one time, and the increase of size the Board deems judicious on account of the probable future commerce of the river and the slight increase of cost in thus widening the lock."¹¹

Building such a masonry lock and timbercrib dam ideally required three years: the first to quarry the stone and mobilize materials and equipment at the site, the second to building a cofferdam ringing the lock and to erect the lock's stone masonry, and the third to constructing the dam. In accordance with mandates and funding from Congress, the Corps began work at Lock 6 in 1887, awarding a contract for furnishing 11,000 cubic yards of stone to a Cincinnati firm in May 1887, but this firm failed to deliver as required by August 1888 and paid a \$6,000 penalty for its failure. Another contractor took the job and opened two quarries on the Kentucky River without finding the quality stone demanded by the Corps. This contractor then purchased oolitic limestone from Indiana quarries and, after time extensions resulting from labor strikes, delivered it in May 1890. Hence, the delivery of stone for Lock No. 6, ideally done in a year, took three.¹²

Corps Assistant Engineer R. S. Burnett started Lock No. 6's construction in May 1891, building a temporary cofferdam in a "U" around the lockpit, tying into the bank above and below the lock site. This cofferdam consisted of 206 timber piles the size of telephone poles driven into the riverbed with timber stringers spiked to the piles, wooden sheetpiles driven down alongside the stringers, and gravel heaped against the wooden wall thus formed. It protected the work down in the lockpit against seven-foot river rises. After the cofferdam was completed, steam pumps aboard the Corps snagboat *Kentucky* removed water (dewatered) from inside the cofferdam, exposing the rock foundation, and workers in the lockpit stripped off sand, gravel, and loose rock from atop the bedrock, shoveling it into wheelbarrows for removal up ramps or into skips hoisted by wooden A-frame derricks atop the cofferdam. Patching cracks in the bedrock with mortar, the stone masons laid courses of precisely cut stone, one course atop another, to form the massive lockwall masonry. Masons and skilled workers on the Kentucky project tended to be Irish and Italian immigrants, or the sons of immigrants, who learned their trade as apprentices to master masons and followed their craft from one project to another across the nation.¹³

Because the construction of Lock No. 6 went well, Assistant Engineer R. S. Burnett, having the materials at hand, forthwith started the dam. Workers assembled the timbers and bolted the cribs together upstream of the lock, then floated the cribs to their place in the dam, filling them with stone and driving the sheetpiling. Burnett received a hard-earned commendation for completing the 412-foot long and 60-foot wide dam that autumn and opening Lock No. 6 for navigation on December 2, 1891, thereby compensating for the time lost by the stone-delivery contractors. Finishing touches done the following year at No. 6 included building timbercribs to line the riverbank above and below the lock. These were called guidewalls because boats entering or leaving the lock tied to them and used them to align their craft with the lock entrance. Later, the Corps added guardwalls parallel with the guidewalls to guard against the river's current pulling boats out over the dam.¹⁴

Surveys to locate Lock and Dam No. 7 began before No. 6 was completed. Knowing from earlier surveys where the pool formed by Dam No. 6 would become too shallow to provide six feet for navigation at low water stages, a survey party worked upstream toward this point, poling along a shanty boat to serve as office and quarters while surveyors armed with axes, rods, and transits ran a line of levels along the bank. Averaging about a mile a day, the surveyors moved upriver, seeking the point farthest upstream where a rock foundation for Lock and Dam No. 7 could be found and the six-foot depth below the lock entrance could be maintained without much



The steam engine at right powered the derricks hoisting stone for Lock No. 7 in 1897.

dredging. They hammered iron rods down through the riverbottom gravel to determine whether bedrock existed to serve as the lock's foundation. When the rods clanged against rock, the driving stopped, although the surveyors drove the rods enough times to be certain they had not merely hit a boulder. Drilling cores of rock to determine subsurface geologic conditions did not replace the use of driven rods until the twentieth century.¹⁵

Acquiring the land needed for the lock and dam was equally simple. As the surveyors traveled upriver they met with landowners along the banks, conducted preliminary negotiations for the land, and in some cases found owners willing to option their land for a specified price. Because the central sector of the Kentucky River flows through a narrow gorge, the Corps dams there flooded few valuable farmlands. The owners were grateful to have slackwater available for their own use and knew it would enhance the value of their remaining property besides bringing temporary business to their community during the construction phase.¹⁶

At Lock and Dam No. 7's site, however, the Corps met landowners on the Kentucky who were reluctant to sell, forcing legal condemnation proceedings to acquire the properties. While the United Society of Believers in Christ's Second Appearing (Shakers) at Pleasant Hill proved willing to sell their strip of land near Lock No. 7, the High Bridge Lumber Company refused to sell. The company complained the dam would interfere with a sawmill and log boom it had there to catch sawlogs floating down from the headwaters, and it also objected that "during the progress of its construction an irresponsible and undesirable class of people would be attracted to the locality, who would make improper uses of their premises and be liable to set fire to them." After a board of engineer officers reviewed the site surveys and could identify no better site for No. 7, the U. S. Attorney and federal courts condemned the land, a complicated and delaying process.¹⁷

Lieutenant William W. Harts and Assistant Engineer John M. G. Watt established the resident office at High Bridge to direct the construction of No. 7. Watt was a civil engineer with much river project experience, and Harts was a young officer on a developmental assignment for military engineers. Subsequently, Harts made quite a record, conducting emergency operations after the San Francisco earthquake of 1906, directing construction of the Lincoln Memorial in Washington, and commanding the District of Paris during the First World War. Civilians serving in his commands never forgot him driving to the office behind a team of glistening black horses and striding through the office each morning wearing white gloves to check for dust.¹⁸



Log rafts on the river at High Bridge

The completed timbercrib dam at No. 7.



Lieutenant Harts' efficiency became apparent at Lock No. 7, built in sight of the famous High Bridge of the Cincinnati Southern Railway. He had the stone quarried for the lock at Beattyville that was never built boated downriver to the No. 7 site in June 1896, and when it arrived he and Watt had the timber cofferdam surrounding the lockpit completed. They built a doubletrack tramway on an incline into the lockpit to move the heavy stone blocks on two flatcars; a wire cable running around a drum at the top of the incline linked the cars together, and as one carrying a stone went down one track into the lockpit, it pulled an empty car up the other track for loading. On August 4, 1896, the first stone went into the lockwall masonry, and Harts and Watt could have finished the lockwalls by year's end if funding had permitted. After completing the lockwalls in 1897, they supervised building the dam abutment, the 351-foot long, 60-foot wide, and 20-foot high timbercrib dam, and the upper and lower guidewalls. With lockgates and operating machinery installed, Lock and Dam No. 7 opened to navigation on December 11, 1897, after merely two construction seasons and at a low cost. The timbercrib dam, for instance, cost an average of \$2.00 per cubic foot of dam, compared with the \$3.35 per cubic foot cost at Green River Dam No. 5.¹⁹

The following winter, John Watt prepared plans and specifications for Lock and Dam No. 8, twenty-nine miles closer to Beattyville than No. 7. Watt planned to build a lock and timbercrib dam capable of lifting boats eighteen feet. This was the highest lift of any lock and dam in the United States constructed prior to 1900, and it made Watt a recognized lock design expert. He later surpassed the design record he set at No. 8 by designing a lock on the Tennessee River in 1909 with a thirty-nine-foot lift, followed in 1912 by one even higher on the Panama Canal.²⁰

By 1898 the Corps on the Kentucky River had sufficient experience with lock and dam construction to understand precisely how and of what materials such structures should be built. This permitted it to prepare clear contract specifications and allowed it to assure quality control of work by contractors. At this time, Congress was urging the Corps to use contracts for construction, and in compliance the Corps contracted for the construction of Lock and Dam No. 8, the first Corps lock and dam on the Kentucky River built entirely by contract. Thomas A. Sheridan of Buffalo, West Virginia, won the contract for constructing No. 8 in September 1898 with a \$261,000 bid. Adding engineering overhead and related expenses brought the cost of No. 8 very close to the \$300,000 estimate made by Harts and Watt.²¹

Construction procedures at No. 8 differed little from those at No. 7, except the contractor used a cableway, or highline, to lift stone from railroad cars at High Bridge and put it aboard barges for shipment upstream to the Lock No. 8 site. Rowan County freestone served as backing for the lockwalls, which were faced with oolitic limestone from Indiana. Other than schedule slippage requiring a contract extension, Thomas A. Sheridan Company performed its contract well, and John M. G. Watt opened No. 8 to navigation on October 15, 1900, bringing nineteenth-century stone masonry and timbercrib construction to a close.²²

Maintenance costs for the timbercrib project gradually climbed from \$15,000 annually in 1884 to \$66,000 in 1900. This growth reflected the increase in the number of operational locks and dams on the Kentucky from five to eight and the high costs of maintaining a timbercrib project. In addition to minor repairs every year, the leaky timbercrib dams frequently required major repairs. For example, Dam No. 1 leaked so freely during the drought of 1887 that its upstream pool fell three feet below the dam's crest, and the Corps had to rebuild it in 1888. The Corps accomplished this by driving piling across the river in a line sixteen feet upstream of the dam and filling the space between the piling and the dam with stone, and by raising the dam's crest another six-inches to compensate for its settling.²³

On the timbercrib project, the Corps acquired a large government floating plant, commonly known as the Kentucky River repair fleet. It transferred the *Kwasind*, built in 1879 for the Wabash River project, to the Kentucky River project in 1884, where it was re-named the *Kentucky*. Called a "snagboat," it kept the navigation channel clear of snags (fallen trees) and it towed dredges, derrickboats, and scows of the repair fleet to the maintenance sites. Captain James Browinski commanded the *Kentucky* until the Corps replaced it in 1893 with the snagboat *Orlando M. Poe*. The *Ward*, built in 1872 at the Louisville and Portland Canal, became the first Corps dredge on the Kentucky in 1880, and the *Willie* became the second dredge in 1890; the dredges *Frankfort* and *Carrollton* replaced them in the

Snagboat *General O. M. Poe* and a dipper dredge working at Lock No. 7.



U.S. Snagboat *Kentucky* and Derrick Boat No. 5 used for project maintenance.



twentieth century. Early twentieth century additions to the Corps' Kentucky River repair fleet included the snagboat *Kentucky No. 2* and the towboats *Gregory*, *Chenoka*, *Burnett*, and *Lucien Johnson* along with the launches *Pearl* and *Monroe*.²⁴

The Kentucky River repair fleet at first wintered in the river's mouth near Carrollton, but as project construction moved upstream to Lock and Dam No. 9 and above, a moorage at Lock No. 4 in Frankfort proved more convenient. There, the Corps in 1895 developed a central repair depot, starting with a warehouse, coal storage bin, and tram from the coal bin to the river to fuel the fleet. The Lock No. 4 repair yard gradually expanded to include carpentry shops for lockgate construction, blacksmith and machine shops for fabricating metal parts, and a marine way to drydock boats for repairs. The Corps employed expert craftsmen at the Lock No. 4 yard capable of fabricating and repairing any part of a lock, dam, or Corps boat. Indeed, they built the towboat *Chenoka*.²⁵



Lock house under construction for the resident lock keeper (lockmaster) and his family.

The repair fleet patrolled the Kentucky to assist with construction and major maintenance, but routine maintenance and lock operations remained the responsibility of lockmasters and their assistants at each lock. Before 1880 the state employed at each lock only a single lock keeper who was on call around the clock for lock operations. The Corps, however, employed a lockmaster and an assistant at each lock, and by working alternate shifts these could get uninterrupted sleep. Where the state had built only a single lockhouse for the lock keeper and his family at each lock, the Corps' two-lockmaster system required housing for two families. In addition to the state's lockhouses built before 1880, the Corps during the 1890s built second lockhouses at Locks Nos. 1 through 5 and built two new lockhouses at No. 6 and the upstream locks. The lockmasters lived on the government land, called reservations, adjacent to the locks in neat, functional houses built for the purpose. They raised their families in the lockhouses and cared for the houses as they would their own, spending spare hours making minor repairs on the houses and reservations and gardening to provide their families with fresh vegetables. To make each reservation a pleasant place to live, the Corps at the turn of the century acquired trees, shrubs, and seed from the Department of Agriculture for landscaping the grounds.²⁶

The primary mission of the lockmasters and their assistants was to move traffic smoothly and expeditiously through the locks. They did this manually for more than a century, turning capstans to operate the lockgates and levers to open and close the valves letting water in and out of the lock chambers. Although done manually, lockage was swift under optimum conditions. At Lock No. 7, for instance, it took two minutes for a boat to enter the chamber, two minutes to close the lockgates behind it, five minutes to fill or empty the chamber to raise or lower the boats, two minutes to open the other set of gates, and two minutes for the boat to exit. This thirteen-minute total for the 52- by 147-foot locks compared favorably with Ohio River locks (600 by 110 feet chambers) that required from twelve to twenty-nine minutes for each lockage and also the Poe Lock (800 by 100 feet chamber) in Michigan that required forty-six minutes per lockage.²⁷

From the beginning, lockmasters took considerable abuse from an impatient public, especially from rowdy raftsmen. "Much difficulty has been experienced during the past year in maintaining discipline and preserving order at the various locks," the District Engineer reported in 1886. He explained that rules concerning which type of craft had precedence in lockage and what safety precautions should be observed were "constantly being violated by pilots, masters and raftsmen." The Corps sometimes took legal action against flagrant rule violations, but this enforcement did not prevent troubles, especially among the fishermen and recreationalists on the Kentucky. Unlike many other rivers in the nineteenth and early twentieth centuries, the Kentucky River recreation traffic

was so significant that the lockmasters recorded it, naming the boats and listing their dimensions. More than fifty "pleasure boats" navigated the Kentucky at the end of the nineteenth century, most of them on excursions to view the towering palisaded cliffs between Frankfort and Boonesborough.²⁸

Fishing for sport and dietary supplement was so important on the Kentucky that the Commonwealth's first fish commission began stocking the river in 1877 with fish including California salmon, apparently in hope the salmon would swim upstream on the Kentucky to spawn. Kentucky River fishermen, including such influential leaders as John Mason Brown, campaigned during the 1880s for the installation of fish ladders at the dams to help fish pass upstream over the dams to spawning grounds. The Corps cooperated with these studies, but Congress did not approve funding for building the fishways.²⁹

Although water cascading over the dams and the park-like reservations attracted many recreationalists, Corps policy discouraged fishing and swimming at the locks for good reasons. Recreation sometimes deteriorated into rowdiness, accompanied by vandalism and disturbing the lockmasters' families who called the reservations home. Fishing and swimming near the dams proved hazardous, not only to fishermen and swimmers but also to onlookers. The captain of an excursion steamboat from Frankfort complained that swimmers on the lockwalls often dropped off the walls into the river as if by accident in order to hear screams from women aboard his boat; and this prank reduced his excursion business. After receiving this and similar complaints, the District Engineer instructed lockmasters that "bathing and fishing from the locks, dams and appurtenances is not approved. If permitted, and accident or death resulted, claim might justly be made for damages in which the U. S. would become involved in defending the lawsuit."³⁰

Perhaps as a result of the lockmasters' strict attention to safety, serious accidents to commercial traffic seldom occurred on the Kentucky River. The first major accident mentioned in Corps records was loss of the steamboat *Hornet* in 1885 when a wind gust smashed its hull against the guidewall at Lock No. 1. "Owing to prompt and efficient aid rendered by the lock keepers," the District Engineer said in his accident report, "no lives were lost."³¹

Other memorable steamboat accidents involved sinkings of the packets *Sonoma* and *Park City* in the pool of Dam No. 1. The *Park City* had a peculiar accident while rounding to at a landing with a shipment of barreled whiskey. A barrel tiered high on the deck fell over during the turn and crashed through the deck, hold, and bottom planking, sinking the boat. Legendary salvage operations followed. The *Sonoma's* sinking drowned four people, and more would have drowned had not the crew of the snagboat *Kentucky* rescued them. Small boat accidents at the dams occurred far more often than accidents to commercial traffic, usually because the boat operators lost control of their vessel and floated down over a dam. While totals were not recorded, Kentucky River lockmen during a century of operations saved dozens of people, mostly in small boats out for a lark, from drowning.³²

With project operations came new regulatory responsibilities. In the River and Harbor Act of 1888, Congress directed the Corps to require the alteration of bridges obstructing navigation, and with this authority the District Engineer forced the raising of railroad bridges at Worthville and Frankfort and the St. Clair Street bridge at Frankfort to permit boat passage beneath them at high water stages. By 1894 the railroad had raised its bridges and Frankfort had replaced its St. Clair Street bridge with a higher, single-span bridge. The Corps thereafter reviewed all plans for bridges built over the Kentucky and its navigable tributaries to assure that they would not obstruct river traffic.³³

A small towboat moves a lograft under Frankfort's Singing Bridge. (From Chinn Collection, Centre College.)



Lograft on South Fork of Kentucky River near Booneville awaiting high water to go to a sawmill.

Under authorities codified in the 1899 River and Harbor Act, or the "Refuse Act," the Corps sought to curtail use of the Kentucky River as a public dump. The Kentucky's Assistant Engineer in 1898 reported "the dumping of refuse from stables and sawmills into the river or on its banks where it might be carried off by high waters has been stopped." Although courts subsequently ruled there should be a proven connection between dumping into the river and its obstruction to navigation before the "Refuse Act" could be used to prevent it, the Corps enforced the law to the limit allowed by the courts.³⁴

Floated and rafted logs, the largest commercial traffic on the Kentucky River during the late nineteenth and early twentieth century, posed the most persistent regulatory problem. After cutting out timber in the lower valley, lumbermen moved upriver and made the transportation of sawlogs downriver to sawmills a big business. In the mountains along the Three Forks, lumbermen pinned logs together with saplings laid lengthwise across the logs. They drilled holes through the saplings into the logs and drove hickory pins into the holes to tie lografts together, a task later accomplished by passing cables through iron rings spiked into the logs. Raftsmen steered the sawlogs down the Three Forks and the Kentucky River with rudders made of poplar poles and boards. They piloted small rafts about ten feet wide and a hundred feet long down the Forks to Beattyville, where they chained three or more of these together for their voyage to sawmills as far away as Louisville. Kentucky River rises of late November and the "tides" from February to May of each year allowed skillful raftsmen to pass over obstructions in the unimproved channel above slackwater navigation.³⁵

Lumbermen also dragged sawlogs to the nearest creek, branded their mark on the logs and let floods carry them downstream to booms at the sawmills. Made of logs chained together and stretched across the river, the booms caught the loose logs floating downriver, and workers at the sawmills pulled the logs from the booms and sawed them into lumber shipped throughout the United States and abroad. In 1894, twelve log booms operated at sawmills along the North Fork and the Kentucky River, annually handling 250,000 logs amounting to 75 million board feet of lumber worth more than a million dollars. The Asher Lumber Company at Ford was the largest of these mills, catching 75,000 logs yearly in its boom.³⁶

When holding logs, the booms obstructed boat traffic, and the loose sawlogs floating downstream to the booms also were hazards. The sawlogs damaged wooden boat hulls and the timbercrib dams, smashing against the dams as they passed over and breaking apart the timbercribs. For this reason, the Corps in 1895 prohibited the operation of booms and floating of loose logs on the Kentucky River slackwater. This restriction ended log boom operations on the slackwater downstream of High Bridge at Lock No. 7 in 1895, and the prohibition proceeded upstream as the Corps completed Lock and Dam No. 8 in 1900 and additional locks and dams farther upriver. Sawlogs continued moving on the slackwater, however, when tied together in rafts, and it became customary for small towboats to push the rafts to the sawmills.³⁷

Commercial tonnage on the Kentucky climbed steadily from 1884 to 1892, when it reached a total of 431,846 tons. Half of this tonnage was coal, either Pittsburgh coal towed from the Ohio up the Kentucky to Frankfort or coalboats descending from the Three Forks to Frankfort. Coal tonnage declined after 1892 from 200,000 tons annually to 50,000 tons in 1895. This reduction resulted in part from the major economic recession that began in 1892, but in 1894 the last coalboat arrived at Frankfort from the Three Forks. A railroad penetrated into the Three Forks region in 1892 and coal from there subsequently went to market via the new railroad.³⁸

Since the 1830s, proponents of extending slackwater navigation up the Kentucky to the Three Forks had asserted this would open the mineral resources of the upper valley to development. Development of the coal, iron, and salt resources would require use of the river to transport major tonnages to markets along the lower river and on the Ohio. Destruction of the Goose Creek saltworks during the Civil War had ended the saltboat trade down the Kentucky River, however, and during the 1870s Kanawha River salt shipped up the Kentucky had absorbed the market formerly supplied from the Three Forks. The last ironboat from the dying Red River iron industry had descended the Kentucky in 1886. The additional loss in 1894 of the coalboat traffic immediately bought the value of continuing lock and dam construction upstream of Lock No. 7 into question.³⁹

In 1896 the Chief of Engineers requested his District commanders to report their judgment on the worthiness of their projects. In response, Lieutenant William W. Harts, then managing the construction of Lock and Dam No. 7 at High Bridge, conducted a fresh economic review of the Kentucky River project. He reported that upstream of Lock No. 7 there were only three towns served by river transportation: Ford with a population of 381, Irvine with 500 people, and Beattyville with a thousand mountaineers. Such a small population would never support a thriving steamboat packet commerce. He found the principal river commerce on the upper river section consisted of sawlogs, and the locks and dams hindered rather than helped this commerce.⁴⁰

Reviewing earlier records, Harts learned that the project rationale was based on the premise that slackwater navigation would transport coal from Beattyville at the Three Forks down the Kentucky to ports along the Ohio River. Yet, coalboating had ceased and even the new railroads serving Beattyville were moving but little coal, only 39,116 tons in 1895. The Kentucky River's narrow and winding channel and its small locks were so restrictive that a four-barge coal tow running night and day would take three days to descend from Beattyville to Carrollton. In the same three days time, tows of twenty-four coal barges running down the Ohio from Pittsburgh could reach Carrollton. This, Harts thought,

would prevent Beattyville coal from ever competing in the Ohio River trade and its market therefore would be limited to local consumption along the Kentucky River itself.⁴¹

Estimating that each lock and dam built upstream of No. 7 would cost \$300,000, or a total of \$2.4 million, plus operating costs of at least \$100,000 annually, Lieutenant Harts concluded:

*This cost is so large and the benefits to be obtained depend so much on the capacity of the coal-fields and the cheapness of marketing coal, that the question at once arises whether it is certain that the general benefits to the United States will justify the enormous expense. It would be a matter of much chagrin if, upon completion of the system, but little coal was found or the commerce in coal should be found to be so unprofitable as to make it impossible to compete with other coal regions. The United States would then have an extensive slackwater system on its hands, expensive to maintain, with little or no commerce to justify the expenditure.*⁴²

Impressed by Harts' report, the District Engineer sent it to the Chief of Engineers with his concurrence that the Kentucky River was unworthy of improvement upstream of Lock and Dam 7. Instead of stopping the project, however, Congress placed it in 1896 under the "continuing contract" system to accelerate its construction. This system authorized the Corps to contract for building more locks up to the full amount of the estimated project costs without awaiting specific congressional authorization for each structure.⁴³

The Corps in 1896 still carried out the Kentucky River project under its 1883 estimate that a total of fifteen locks and dams at a cost of \$1.3 million would be necessary to extend slackwater to Beattyville. This 1883 estimate had become entirely inadequate, requiring the Corps to restudy the project's design and cost estimates. By increasing the lift at each of the locks planned upstream of No. 7 from an average of fifteen feet to an eighteen-foot average, only seven more locks and dams would be required, reducing the total number of locks to fourteen. The Corps estimated it could build these seven additional locks for \$3 million. Added to the \$1.8 million spent on the first seven locks, total project costs summed up to \$4.8 million.⁴⁴

In view of this immense cost estimate, the District Engineer recommended that the Corps stop the Kentucky River project. "In reality," he said, "the local benefit of the improvement did not justify going above Frankfort, in the fourth pool, which is the only city of importance on the river. The only warrant for the extension upstream was to tap the coal field of Beattyville." The Chief of Engineers concurred and he advised Congress that it should reconsider its authorization for the Kentucky River project.⁴⁵

Begun in 1880 with restoration of the Commonwealth's five locks and dams, the Corps' timbercrib project came to an end when Lock and Dam No. 8 opened to navigation on October 15, 1900. After restoring the state's locks and dams from 1880 to 1886, the Corps completed three more stone masonry locks and timbercrib dams. It finished Locks and Dams Nos. 6, 7, and 8 in 1891, 1897, and 1900 respectively. During the twenty-years it continued the timbercrib project, the Corps' experience indicated that four to five years were required to build each new lock and dam. At this rate, it would take another twenty-five to thirty years and \$3 million to build six more locks and dams and reach the project goal at the Three Forks.

The Kentucky River slackwater project fostered a growing waterborne commerce until 1892 when competition from railroads began to reduce the tonnages moving by river. When a new railroad was built into Beattyville at the Three Forks in 1894, the Corps recognized the Kentucky River project rationale as no longer economically viable.

It recommended to Congress that funding for the Kentucky River project cease with the completion of Lock and Dam No. 8. Congress, however, decided otherwise, directing the Corps to accelerate its construction on the Kentucky and to show speedy and concrete results.

Kentucky River

10

THE CONCRETE RESULTS

The main object of the improvement, as I understand, is to give a cheap means for transporting the coal found in the headwaters of the Kentucky River to market. The sooner these means are provided the better for those concerned.

Thomas H. Handbury, 1901

The beginning of the twentieth century marked a transition for the Kentucky River project: the Corps of Engineers accelerated its march upriver toward the Three Forks coal fields and adapted twentieth century technology to fit project conditions. Abandoning the stone-masonry and timbercrib project of the nineteenth century, the Corps switched to concrete and steel design and construction, thereby providing reduced maintenance costs at the locks and dams built upstream of No. 8. By speeding land acquisition for the projects and by contracting for nearly simultaneous construction of several structures, the Corps managed to complete Locks and Dams Nos. 9, 10, 11, and 12 in nine years from 1901 to 1910. During this decade, it brought a new lock and dam into service every two years, about half the time it required to complete stone-masonry and timbercrib structures during the nineteenth century.

Corps efforts to accelerate the Kentucky's concrete project, however, disrupted the valley's logging and lumber industry and caused a flanking disaster at Locks Nos. 9 and 10 in 1905. Through regulation and litigation, the Corps forced the lumber industry on the upper river to adapt, switching from loose logging and booms to rafting and towing to prevent blocking the river and damaging the dams with log jams. A flanking debacle at Nos. 9 and 10 in 1905, costing \$200,000 and delaying progress a year or more, in turn forced the Corps to reassess its plans for Locks and Dams Nos. 11, 12, 13, and 14. Instead of building fixed concrete dams on the upper river, the Corps adapted to the Kentucky's severe flooding conditions by changing to movable dam crests. These movable crests could provide a six-foot minimum depth for slackwater navigation to the Three Forks with just fourteen locks and dams and at the same time help secure the structures against additional flanking disasters during flood conditions.



A saw log jam at Ford, Kentucky blocked the river in Nov. 1906. Sawmill in right background. (From Maurice Flynn, Winchester, KY.)

Towboat *Georgie* makes the first lockage through Lock No. 11 on Dec. 11, 1906



At the onset of the twentieth century, the Army Corps' Chief of Engineers created an intermediate administrative office known in 1901 as the Central Division and later as the Ohio River Division at Cincinnati, Ohio. Designated the Division Engineer, the officer commanding at Cincinnati received overall responsibility for managing water resource development on the Ohio River and its tributaries including the Kentucky River. As his first Division Engineer at Cincinnati, the Chief of Engineers appointed Colonel Thomas H. Handbury; and after 1901 the District officers with direct charge of Corps projects in the Ohio River basin reported to the Chief of Engineers through Colonel Handbury and his successors at Cincinnati.¹

Colonel Handbury initiated his Central Division command by inspecting progress of the projects within his purview. In November 1901 he boarded a steamboat and proceeded up the Kentucky River to inspect the project and observe the start of construction for Lock and Dam No. 9 at Valley View. After completing his inspection and review, Handbury advised the Chief of Engineers:

In carrying out the project for the improvement of this river a policy seems to have been adopted of finishing each lock before commencing any work on the one next above, on the ground that by furnishing water transportation the work could be done cheaper, and lower bids would be obtained, and there did not seem to be any urgent necessity for pushing it to an early completion. I doubt the wisdom of this. The main object of the improvement, as I understand, is to give a cheap means for transporting the coal found in the headwaters of the Kentucky River to market. The sooner these means are provided the better for those concerned. The remaining locks and dams of the system should be definitely located, title to their sites obtained, and as soon as funds are provided the work of their construction should be commenced and pushed forward as rapidly as possible.²

Colonel Handbury ordered Major Ernest H. Ruffner, the District Engineer in charge of the Kentucky River project, not to await the completion of Lock and Dam No. 9, but to immediately prepare the plans for No. 10 and to acquire the sites of Nos. 11 and 12. As desired by Kentucky's congressional delegation, Major Ruffner should accelerate construction of the Kentucky River project.³



This view of the completed Lock No. 10 shows the original dam on the left and the auxiliary dam closing the 1905 breach on the right. Boonesborough Beach is at the far right.

Assigned charge of projects on the Kentucky and other Ohio River tributaries in 1901, Major Ernest H. Ruffner was well known within the Corps for active command management. The scion of a pioneer West Virginia family who graduated first in his class at West Point, by 1901 Ruffner had thirty years experience as a Corps officer and waterways engineer. He had served as District Engineer on the Kanawha River project where the Corps rapidly completed ten locks and dams by 1897 to open river transportation to the West Virginia coal fields. Although known for swift results, Ruffner also had a rough reputation. Subordinates thought it a "trial" to serve in his command, and fellow officers considered him peculiar. He once ordered a contractor to excavate a lock chamber with shovels and wheelbarrows, and when the contractor complained this costly procedure would bankrupt him, Ruffner angrily replied in writing that it would be a pleasure to break him. The contractor did the work as ordered and then sued, presenting Ruffner's letter as evidence and receiving a large court award.⁴

Major Ruffner launched the campaign to finish the Kentucky River project by reorganizing his Cincinnati District staff and organization. Senior civilian engineers then managed local project offices, and Ruffner inherited some highly experienced engineers who thought of the streams in their charge as "their" rivers. Among these were Addison Scott, known as "Mr. Kanawha" because he had managed the project on that river since 1870; Edmund Moeser who had directed the Muskingum River project in Ohio for years; Benjamin Thomas, a national expert on movable dams responsible for the Big Sandy River; and John M. G. Watt who had supervised the Kentucky River project locally for fifteen years. Ruffner soon transferred or fired all of these, losing an irreplaceable reservoir of talent and experience.⁵

Charged with accelerating the Kentucky River project, Ruffner clashed with the senior engineer in charge at Frankfort, John M. G. Watt. Thinking Watt devoted too much attention to project operations and not enough to planning and building Locks and Dams Nos. 9 and 10, he hired John Westerfield as chief of Kentucky River operations and ordered Watt to devote his time to speedy construction of the two new locks and dams. Ruffner's pressures on Watt for swift action proved so intense that Watt suffered "nervous prostration" and took an extended sick leave. Watt never returned to the Kentucky, instead transferring to the Tennessee River where he designed the Hales Bar Lock with a thirty-nine-foot lift, and later to the Panama Canal project for design of its great locks.⁶

As Watt's replacement on the high-priority Kentucky River project, Major Ruffner transferred Benjamin Thomas from the Big Sandy River to Frankfort. A nationally recognized expert for innovative design, Thomas had adopted a new type of movable dam for the Big Sandy project and was interested in redesigning the Kentucky River dams. When Ruffner found that Thomas had too much "individuality" for the Kentucky River project, however, he transferred him back to the Big Sandy. He then hired Thomas Shanks, an assistant engineer from another District, for the Kentucky River, but when Shanks quarreled with construction inspectors at Locks and Dams Nos. 9 and 10, he fired him. Without a senior civil engineer left in service on the Kentucky, Ruffner promoted his office draftsman, Charles Walthers, to Assistant Engineer and hired two junior engineers to assist Walthers. One was William H. McAlpine, then fresh out of the Massachusetts Institute of Technology. Forty years later, McAlpine became the senior civilian engineer in the entire Corps, and in the 1960s the McAlpine Locks and Dam on the Ohio River at Louisville was named to honor his capabilities.⁷

Ruffner's reorganization of Kentucky River project operations was no less sweeping than his revision of its engineering and construction. While inspecting the Kentucky River locks, Ruffner became upset by the neglect of accountability. He found tools and equipment scattered at locks up and down river with no apparent organi-

zation, and he found no one who knew what equipment was on hand or whether it was serviceable. "Generally it was easier to buy new," Ruffner lamented, "than to try to use what was on the returns." To remedy this neglect, he ordered a property storehouse built at Lock No. 4 and employed a clerk to travel the river, collect and inventory the property, and return it to Lock No. 4 for storage or disposal.⁸

While seeking improved property control, Ruffner learned that one of the lockmasters could neither read nor write and he fired him on the spot. In a subsequent protest of this to the Chief of Engineers, the lockmaster pointed out he had worked at Kentucky River locks for two decades, with his daughter helping complete the paperwork. "I must confess it does seem hard after all my long and faithful service to the Government," the lockmaster complained, "that my discharge should be asked with no complaint against me except that I cannot read and write."⁹

The Chief of Engineers informed Major Ruffner that he would not sanction the discharge of faithful employees, and he recommended that Ruffner transfer the lockmaster to another position more suited to his abilities. When Ruffner sharply responded that he would reluctantly comply, the Chief, just as curtly, replied:

*"The contumacious tone of this and other letters recently written by Major Ruffner has not escaped the observation of, and is condemned by, the Chief of Engineers, who is surprised that an officer of Major Ruffner's length of service does not appreciate that his first duty as a District Officer is to administer his works in a way to promote harmony in his district and to assist his superiors rather than embarrass them. A little tact in his conduct towards his men and a cheerful obedience to the regulations prescribed by this office, will tend not only to promote the interests of the service but to benefit the official record of the officer."*¹⁰

During Ruffner's troubled tenure on the Kentucky, his major achievement was to convert the project from nineteenth-century stone masonry and timbercrib materials to twentieth-century concrete construction, starting with repairs to the timbercrib dams on the lower river. Lacking experienced civilian engineers, Ruffner personally supervised the repairs to Dam No. 1 near Carrollton. After tearing out the deteriorated top section of the timbercrib dam, Ruffner did not rebuild it; instead, he capped the dam with concrete that was four to eight feet thick and extended it down the dam's upstream side to reduce leakage through the dam. To prevent erosion and undermining of the dam's downstream slope, he also changed the concrete slope's angle to redirect river flow upward at the dam's toe. During the following decade, the Corps capped all the Kentucky's nineteenth-century timbercrib dams with concrete to reduce both leakage and the high maintenance costs that had plagued the project since its original construction in 1841.¹¹

The switch from wooden timbercribs to concrete on the Kentucky grew out of technological advances in structural design at the turn of the century. First developed in England, Portland cement, which mixed with sand and stone to form concrete, came to America aboard ships from England, and the transportation costs prohibited its extensive use for construction. When commercial cement manufacture began in America during the late nineteenth century and quality controls were established, engineers began using structural concrete: the first concrete-paved road was built at Bellefontaine, Ohio, in 1893; the first reinforced-concrete arch bridge was raised in 1893 at Philadelphia; and the Louisville Engineer District completed the first concrete river-navigation lock in the nation on Western Kentucky's Rough River in 1895. Ruffner's application of structural concrete on the Kentucky River represented but one facet of a technological revolution then underway throughout the nation.¹²

New applications of steel for construction complemented developing concrete technology. Structural concrete required the steel reinforcement produced by the commercial steel manufacturing that developed near the turn of the century in the United States. The growing steel industry manufactured structural steel that also could be

used in lockgates, dam crests, and other movable components of waterways projects. Although concrete and steel applications sharply increased the first costs of construction, their lengthy design life far exceeded that of wooden timbercrib structures, producing savings in long-term maintenance costs that engineers could not ignore.

Before Major Ruffner arrived on the Kentucky, John M. G. Watt and Captain Harry Hodges had applied the new structural concrete and steel designs to plans for Lock and Dam No. 9. Captain Hodges designed steel lockgates for Lock No. 9 that were similar to the lockgates he had designed for the Poe Lock in Michigan. Heavier than the wooden lockgates used earlier on the Kentucky, the steel gates swung open and closed

like double doors; and when closed they rested against miter sills at the bottom of the lock chamber and on sturdy hollow quoins (flat shoulders) at the top of lockwalls. As another contribution to reduced operating costs, Hodges changed the Lock No. 9 design from wrought-iron butterfly valves to steel cylindrical valves, or bonnet valves, that served to fill or empty the lock chambers of water. The cylindrical valves could be operated by a single lockman where the butterfly valves had required two. Reducing high operations and maintenance costs through the use of structural concrete and steel thus became a major goal of engineers on the Kentucky and other waterways.¹³

Although Major Ruffner started the construction of Lock and Dam No. 9 in 1901, Kentuckians continued to urge accelerated work on the upstream locks and dams. The Commonwealth's governor and congressmen predicted the development of major coal commerce as soon as slackwater navigation opened to Beattyville at the Three Forks. They forecast that Kentucky River coal would compete with the massive coal shipments barged down the Ohio River from the Monongahela and Kanawha rivers in Pennsylvania and West Virginia. To these requests for acceleration, Ruffner responded that he was working upriver with all the speed he could muster. "You must understand that the great draw-back in speedy progress on the Kentucky River," he elaborated, "is the time necessary to acquire the land." He mentioned that his office had sent the papers necessary for acquiring Lock No. 9's site to Washington for action in July 1898, but legal formalities for land purchases had not been completed until December 1900, a sixteen-month delay. Ruffner assured Kentuckians that he would have construction of Nos. 10 and 11 well underway before No. 9 was completed. These structures would bring the head of slackwater navigation to within thirty-five miles of the Three Forks and the adjacent coal fields.¹⁴

Major Ruffner awarded the contract for building the first concrete and steel lock and dam on the Kentucky to the Sheridan-Kirk Company in June and the company straightway began work in July 1901. To assure quality, the contract provided that the Corps would furnish the Portland cement, and it purchased 20,000 barrels of cement and delivered it to the contractor at Valley View. The contractor mixed and poured the concrete while subcontractors fabricated and delivered the lockgates and metal appliances. Sheridan-Kirk Company had substantial experience in building waterway projects for the Corps of Engineers and it made a forthright record at Lock and Dam No. 9. It assembled materials and equipment at the site in 1901, built the lock in 1902, finished the dam in 1903, and opened Lock No. 9 for navigation on December 3, 1903.¹⁵



Test operation of the steel lockgates at Lock No. 10.

A major change in construction methods at No. 9 from those used at the earlier locks and dams involved using cofferdams, the temporary structures that hold out river floods while excavation and construction are underway. Although cofferdams had been used at the downstream locks to “dewater” the lockpit while workers laid the stone masonry, the timbercrib dams had been built “in the wet” without cofferdams. Concrete dams needed time to dry and harden, however, and Sheridan-Kirk Company at No. 9 built three cofferdams: one surrounding the lock site, another across the river around the dam’s abutment, and a third for the central dam section. Three cofferdams were necessary because a cofferdam surrounding the entire dam would have closed the river entirely, forcing its flow through the lock chamber during construction and creating hazardous, erosive currents.¹⁶

A year after awarding the contract for No. 9, Major Ruffner opened four competitive bids for building No. 10 at Boonesborough and awarded the contract to Mason and Hoge Company of Frankfort, a nationally known railroad construction firm. Except for contracts to supply lumber and materials and build lockhouses and minor project features, Mason and Hoge Company became the sole firm from the Commonwealth to receive a major construction contract on the Kentucky River. Federal policy did not provide local preference in awarding the contracts, which went instead to the lowest responsible bidders. The Kentucky River locks and dams therefore were built by contractors from Ohio, West Virginia, and Indiana, who brought along their own administrative and engineering staffs and most of their skilled workers. Although the construction benefited the Kentuckians hired as common laborers and proved a boon to merchants in the construction’s vicinity, it did not significantly stimulate Kentucky’s building industry.¹⁷

Mason and Hoge Company’s procedures at No. 10 closely resembled those used at No. 9, and the company performed well until an ice and flanking disaster disrupted progress in February 1905. That month, the upper Kentucky River froze, then a rise broke the ice and packed it into the river channel for thirty-five miles from Beattyville down to Irvine. Locked in the twenty-foot high ice gorge were 300,000 sawlogs completely blocking the channel. Liberal application of dynamite had no discernible effect on the tangled mass, but an early March thaw and rise released the log jam. For two and a half hours, the logs and ice flowed past Irvine, and downriver they crashed over Locks and Dams No. 9 and 10 and found their way behind the locks to flank them.¹⁸

Engineers called it “flanking” when a river scoured a new channel for itself around a dam’s abutment or behind its lock. This costly mishap forced project reconstruction and almost always resulted from lack of sufficient care in either the project’s design or construction phase. In an earlier chapter, the November 1881 flanking disaster at Lock and Dam No. 1 was recounted. There, the resident engineer delayed completing the fill behind the finished dam and abutment before a sudden flood rose over the structure, creating a substantial head of water, overtopping the uncompleted fill, and shortly scouring away the fill to open a new channel behind the dam’s abutment. Repairing the damages at No. 1 had cost \$60,000 and delayed the restoration of navigation to Frankfort. The flanking debacle at Locks and Dams Nos. 9 and 10 in 1905 proved even more costly.¹⁹

Promoted to Lieutenant Colonel, Ernest Ruffner reacted quickly in March 1905 when news arrived that the flood, ice, and logjam had dug new channels behind Locks No. 9 and 10. He arrived at the disaster scene aboard the snagboat *General O. M. Poe* on March 12 to close the breaches behind the locks. In the meantime, 500 rafts containing 40,000 logs waited at Ford, where their owners tied them to the banks until navigation reopened. Newspapers reported that raftsmen complained bitterly of the delay, “and the Government engineers that drew the plans and specifications of the dam are being severely criticized.”²⁰



Log rafts and towboat on North Fork at Jackson, KY.
(From Charles Hayes, Jr.)

Ruffner had his workers quickly assemble timbercribs and attach them with wire cables to the snagboat *Poe*. He planned to guide the timbercribs with the *Poe* as they floated down into the gaps and were filled with stone to block the flow behind the locks. The flood's terrific power snapped the cables, however, preventing closure of the breaches until the river receded. The river scoured a new 200-foot wide and 38-foot deep channel through the breach behind Lock No. 9, and at Lock No. 10 the breach eroded to a width of 240 feet and depth of 40 feet, even undermining and sweeping away a newly completed lockhouse.²¹

The Chief of Engineers appointed a board of engineer officers to investigate the debacle at Locks Nos. 9 and 10. This board reported in April 1901 that the damage had resulted from a failure to protect the fill back of the lockwalls when the river flooded. Lacking a cover of rock or paving, the unconsolidated fill had been torn loose by ice and logs and washed away by the flood, and the board concluded that responsibility for this disaster belonged to the District commander. Accepting this responsibility, Colonel Ruffner responded:

*"There can be but one person responsible for affairs on the Kentucky River, and such responsibilities cannot be shared. I have stated, and I repeat it, that the error rests with me in that I did not fully foresee the dangers from the conditions that I encountered. It was my duty to anticipate and provide for all contingencies, and this I unfortunately did not do. Now that the danger has occurred anyone can see what has happened and, inasmuch as no officer, or assistant, or employee foretold or warned of the danger possible, the experience alone has brought this out. But, I think that I am now fully capable and peculiarly fitted to carry out plans that will correct the disasters and prevent them in the future."*²²

Ruffner further explained the failure's ultimate cause lay in a phrase in the construction contract that had escaped his attention. This specification required: "The paving shall in no case be placed until nearly all the embankment and back fill has been subject to exposure during winter and spring rains." This specification intended to permit the new fill to settle before covering it with permanent paving, which the settlement would have broken. Ruffner recognized he should have required the contractor to install temporary rock protection atop the fill to prevent its washout during the winter floods.²³

Contrary to Ruffner's opinion, however, the disaster's ultimate cause was not this contract specification. It was Ruffner's command management technique. Attempting to comply with demands for project acceleration, Ruffner fired or drove away the project's senior civilian engineers, who in Ruffner's opinion moved too slowly. As a result he lost the design and construction experience that might have recognized the dangers and implemented measures needed to protect against flanking. This neglect cost Ruffner his career. He left the Kentucky River under a cloud and soon retired. When he sought to rejoin the Army for service during World War I, the Chief of Engineers, remembering what happened on the Kentucky, rejected his application.²⁴

After the 1905 flanking the Corps acted to further restrict the floating of loose logs down the Kentucky to sawmills, and this action casts light on the character of the upper river's commerce. The Corps had earlier prohibited the floating of loose sawlogs on the slackwater and down over the dams to log booms at sawmills, and as a result the log boom businesses had moved upstream as new locks and dams opened for traffic. A large sawmill and log boom business at Frankfort, for ex-

ample, relocated upstream to Heidelberg. When the Corps proposed extending its prohibition of loose logging all the way to Beattyville, sawmill owners protested vigorously, and the District Engineer directed junior engineer William H. McAlpine to investigate their complaints.²⁵

Sawmill and log boom owners claimed correctly that theirs was the largest commerce on the upper river. At Irvine and above they collected 300,000 logs worth \$1 million annually in their booms. They protested that closing the river to loose logging would not only end their business, it also would greatly distress the mountain economy, where logging produced "practically all the money in circulation." To check this claim, William McAlpine personally interviewed people engaged in loose logging. He learned that mountaineers needing cash quickly sold their logs lying in the streams tributary to the Kentucky directly to traveling buyers for the mills. They received, however, only sixty percent of the price paid to mountaineers who waited for a river rise to raft their logs down to the sawmills. McAlpine reported that loose logging in this sense robbed the poor of income, and it also wasted lumber because many logs sank to the river bottom before reaching the mills. Because the loose logs obstructed navigation, damaged the dams, and wasted lumber, McAlpine declared the practice was not in the public interest. He recommended ending the floating of loose logs down the Kentucky and the Chief of Engineers approved, prohibiting the practice downstream of Beattyville at the end of November 1909. Loose logging thus ceased on the Kentucky River, although it continued along the Three Forks upstream of Beattyville.²⁶

Sawmills along the Kentucky stayed in business after 1909 by rafting their logs, often chartering gasboats to tow lografts through the locks to downstream mills. Developed during the 1890s, gasboats were powered by small internal-combustion engines fueled with kerosene; they were forerunners of the diesel-engine craft that eventually supplanted steamboats. Their small size made them ideal for navigating the Kentucky's unimproved channel upstream of Lock and Dam No. 10 and guiding lografts through the locks to the mills. Indeed, the lograft tows became so large that they sometimes obstructed navigation by other craft.²⁷

After the towboat *Sea Lion* took a quarter-mile-long, sixty-seven-raft tow of logs down the Kentucky, William McAlpine studied the lograft towing traffic. The *Sea Lion's* huge tow had required a day and a half of continual lockage at each lock it passed, and it took the tow nearly a month to transit all locks on the Kentucky. Large lograft tows blocked use of the locks by other craft and posed staffing problems because Corps lockmasters were limited by law to eight-hour work days. McAlpine recommended restricting lograft tows to a 1,000-foot total length and 64-foot width, and the Corps adopted this restriction as policy. When lumber interests evaded this constraint, McAlpine also initiated litigation to stop them, using Captain Squire Preston and his towboat *John A.* as the test case.²⁸

Captain Squire Preston of Salvisa had piloted steamboats including the *Grace Morris*, *City of Clarksville*, and *Ingomar* on the Kentucky River for thirty years before commanding the towboat *John A.* pushing lografts. When Captain Preston and his *John A.* towed thirty-two lografts totaling 1500 feet in length, it required eleven lockages to pass through each lock. When a lockmaster overheard the crew boasting about their evasion of the 1,000-foot restriction, William McAlpine reported the violation to the District Engineer and U.S. Attorney for action. Towboats thereafter became more circumspect in their lock approaches and conducted a prosperous lografting commerce on the Kentucky until profitable timber harvests ended during the 1930s.²⁹

McAlpine was still the junior engineer on the Kentucky River in 1905 when Colonel Ernest Ruffner departed and the responsibility for repairing the flanking damages at Locks and Dams Nos. 9 and 10 went to Colonel James G. Warren. These repairs consisted of building a second auxiliary dam behind each of the two locks.

These concrete dams closing the new channels behind the locks were higher than the original dams to assure that the river did not again bypass the locks. Completed in 1906 at a cost of \$200,000, the repair modifications left Locks Nos. 9 and 10 standing between two dams, seemingly constructed in the middle of the river.³⁰

The flanking of Locks Nos. 9 and 10 led to reconsideration of designs for No. 11 near College Hill. Its design originally was nearly the same as those of Nos. 9 and 10: a fixed concrete dam with a lock lift of eighteen feet. Thinking the height of Dams Nos. 9 and 10 might have restricted the river's flow and invited the flanking disaster, the investigating board of officers thought the height or lift of No. 11 should be reduced—it was to be built in a river bend where low-lying bottom land flooded at higher river stages. The proposed redesign provided No. 11 with a lift of fourteen feet, several feet less than Nos. 9 and 10.³¹

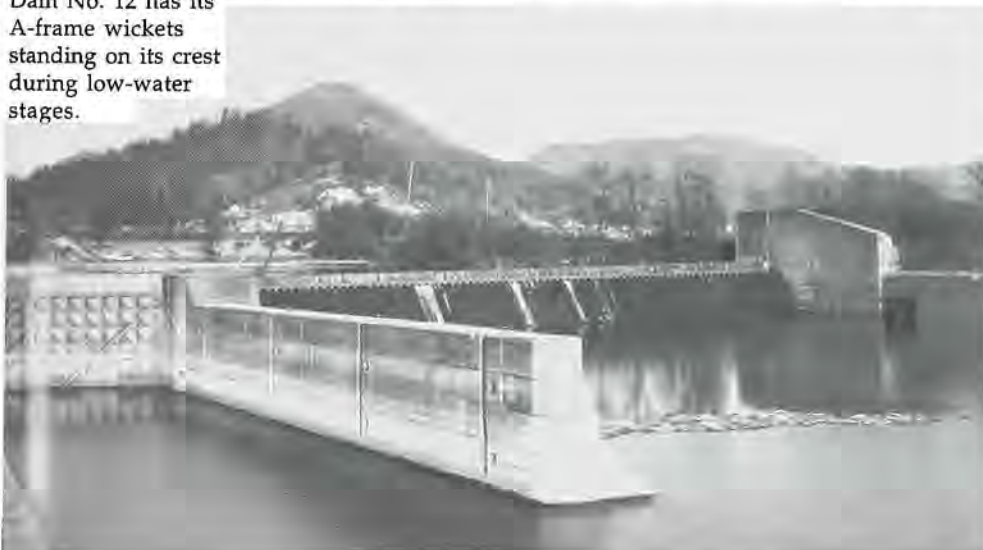
H. E. Talbott Company of Dayton, Ohio, had contracted for building Lock and Dam No. 11 in September 1903, and built a mile of access road and two inclines to move equipment and materials from the road to the lock site. Because the narrow channel at the site abutted against a high bluff, Talbott Company elected to erect an elaborate wire cableway of highlines to handle materials and excavation, eliminating the dredges and derricks customarily used for lock and dam construction. Talbott Company was building the lock when the 1905 flanking of Nos. 9 and 10 resulted in major modifications of No. 11's designs.³²

To take charge of Kentucky River designs, the District Engineer brought senior engineer Benjamin Thomas back to Frankfort from the Big Sandy River project. For the Big Sandy on Kentucky's border with West Virginia, Thomas had designed Poiree needle dams; these were movable, rather than fixed, dams. Built of steel trestles that could be raised or lowered atop a concrete foundation, the top of these dams was formed by wooden timbers called needles propped against the steel trestles. These held navigable pools at low water stages and were removed during floods to open the channel. While designing needle dams, Thomas had conducted a world-wide study of movable dam technology, had written the standard text on the subject, and had invented a new movable crest type known as the A-frame wicket dam.³³

After reviewing the plans to lower No. 11's crest by three and a half feet, changing from an eighteen-foot to a fourteen-and-a-half foot lift, Benjamin Thomas proposed lowering the fixed concrete section of the dam further to a crest of twelve feet and topping this concrete foundation with a six-foot high movable dam. This would provide the full eighteen-foot lift at low water stages when the movable crest stood in place, and lowering the movable crest during floods would reduce the dam's height to twelve feet. In submitting his redesign, Thomas pointed out that decreasing the eighteen-foot lifts planned for Dams

Nos. 11, 12, 13, and 14 would force the construction of a fifteenth lock and dam to achieve a six-foot minimum channel depth to the Three Forks and thereby increase total project costs by \$300,000. Installing movable crests atop the concrete dam sections as he proposed, however, would complete the project with only fourteen locks and dams while still reducing the flanking risks during floods.³⁴

Dam No. 12 has its A-frame wickets standing on its crest during low-water stages.



Gaining approval from the Division Engineer and Chief of Engineers, Thomas in March 1906 modified the contract for building Dam No. 11 to specify that the top six feet of the dam would consist of a movable Poiree needle crest like those on the Big Sandy River. This crest design consisted of twenty-six steel trestles spaced eight feet apart and hinged to the top of the fixed concrete foundation. At flood time, the trestles collapsed sideways to lay flat atop the concrete and permit unimpeded flood passage. After floods receded, the lockmen cranked a winch on the lockwall, winding in a chain attached to the trestles and pulling them upright to standing position. When all the trestles were erect, the lockmen installed eight-foot sections of metal walkway from the top of one trestle to the next, creating a walking and working platform atop the dam's crest. From this walkway, the lockmen slid wooden timbers or needles down into the river, resting the needles' lower butt against the concrete dam and upper end against rails along the walkway. When all wooden needles were placed side-by-side, they formed a wooden wall along the dam's crest from the lock to the abutment. This six-foot wooden wall holding the river six-foot higher than the dam's concrete foundation provided the required six-foot slackwater navigation depth upstream to the next lock.³⁵

The contractor finished Dam No. 11 with its movable crest on December 26, 1906. That winter, however, floods and drift surging over the dam broke chains connecting the winch to the steel trestles, and the lockmen could not hoist the trestles after floods had ended. William H. McAlpine had a steel-hull boat, similar to the maneuver boats used to raise wicket dams on the Ohio River, built at Lock No. 4 and sent it upriver to Dam No. 11. Lockmen working on this boat's deck caught the steel trestles with a grappling hook, then winched them into upright position, allowing placement of the walkways and wooden needles. "This is not an easy thing to do with 4 or 5 feet of water on the dam," McAlpine admitted, "but a scheme has been devised by the lockmen which is quite successful in accomplishing this."³⁶

Numerous floods on the Upper Kentucky forced frequent raising and lowering of Dam No. 11's trestles, and this required the employment of extra labor to operate the maneuver boat in the swift currents. Recognizing the hazards and costs of this operating procedure, Benjamin Thomas reconsidered the design for dams to be built upstream of No. 11. Abandoning the Poiree needle dam design, he adopted the A-frame crest design that he had invented. Tested on the Ohio and Cumberland rivers, the Thomas movable A-frame crest design consisted of closely spaced steel trestles that collapsed one partly atop the other, like a row of dominoes. When winched upright into standing position, the wide upstream legs of the A-frames supported wooden panels to form the dam's crest. Because their operation was much simpler than the needle dams, A-frame movable crests were designed for the dams upstream of No. 11.³⁷



Lock and Dam No. 12 completed. Note the three lockhouses, provided because operating the movable dam crest required a crew of three men.



At Dam No. 11 in April 1906, a diver attaches lines to the last crib to be floated into position in the cofferdam around the dam site.

Log raft at Dam No. 11 under construction in 1906



The contract for building Lock and Dam No. 12 with its movable crest, went in June 1907 to the Ohio River Contracting Company of Evansville, Indiana, a firm with considerable construction experience at Ohio River projects. Handling their contract well, the firm completed Lock and Dam No. 12 at Irvine and Ravenna in three working seasons, opening the lock to navigation on January 13, 1910.³⁸

With the completion of Lock and Dam No. 12 at River Mile 220 near Irvine, the Corps project was only thirty-five miles from its destination, the Three Forks coal fields at Beattyville. Yet, Corps officers by 1910 were increasingly critical of continuing the advance toward the Three Forks. When Major John C. Oakes asked for an additional maintenance allotment to pay for removing a rock ledge obstructing the channel downstream of Lock No. 11, the Chief of Engineers questioned whether the amount of commerce there justified this expenditure. Major Oakes testily retorted:

"I am forced to reply that the commerce of the river will not warrant the expenditure of the money for the removal of this ledge, nor, as at present, does it warrant the expenditure of any money for the improvement of this river.

*At the same time, the improvement is being carried on, some of the money being expended at Locks Nos. 12 and 13 and allotted for No. 14, and there is just as much need of the removal of the ledge in question as there is of construction of Locks Nos. 13 and 14."*³⁹

From 1901 to 1910, the Corps accelerated the Kentucky River project and adapted twentieth century technology to fit project conditions. Abandoning the stone-masonry and timbercrib project of the nineteenth century, it switched to concrete and steel design and construction, thereby providing for reduced maintenance costs at the locks and dams upstream of No. 8. By initiating land acquisition for lock and dam sites at earlier dates and by awarding contracts for nearly simultaneous construction of several structures, the Corps managed to complete

Locks and Dams Nos. 9, 10, 11, and 12 in nine years. During the first decade of the twentieth century, it brought a new lock into operation every two years, about half the time required earlier to finish the nineteenth-century stone-masonry and timbercrib structures.

Corps efforts to accelerate the Kentucky's concrete project, however, disrupted the valley's logging and lumber industry and caused the flanking disaster at Locks Nos. 9 and 10 in 1905. Through regulation and litigation, the Corps forced the lumber industry on the upper river to adapt, switching from loose logging and booms to rafting and towing to prevent log jams of the sort that had blocked the river in 1905. The flanking debacle at Nos. 9 and 10 in 1905, costing \$200,000 and delaying project completion, in turn forced the Corps to reassess its plans for the upper river. Instead of building high concrete dams on the upper river, the Corps switched to movable dam crests of the type used on the Big Sandy, Cumberland, and Ohio rivers. These movable crests could provide a six-foot minimum slackwater depth to the Three Forks with just fourteen locks and dams while also helping protect the structures against flanking disasters.

Just thirty-five miles and two locks and dams from its Three Forks destination in 1910, the Corps should have finished the Kentucky River project by 1914 if continued at the pace set from 1901 to 1910. Yet, every soldier knows the last part of any march is the most difficult, and thus it was on the Kentucky. Building Locks and Dams Nos. 13 and 14 proved an ordeal, and the Corps contemplated entirely abandoning the campaign to reach the Three Forks coal fields.

Kentucky River

11

THE FAMOUS PORKBARREL

What has happened to the river trade? What has become of the fine floating palaces and large freighters that formerly plied the trade from points on the Kentucky River to New Orleans? Is the river to be cast into discard just because railroads now connect the cities formerly joined only by water?
Frankfort State Journal, 1917

Because the Corps of Engineers had managed to build new concrete locks and dams every two years during the first decade of the twentieth century, it planned to complete Locks and Dams Nos. 13 and 14 by 1913. It had both structures under contract by 1911, on schedule for extending slackwater navigation to the Three Forks coal fields. Bankruptcy, gunfire, and other untoward events disrupted scheduling, however, preventing timely project completion. Not until 1917, in the midst of the First World War, did the Corps achieve its Kentucky River goal and by then it seemed a pyrrhic victory. Where were the steamboats the project was designed to serve? Why indeed had the project been built at all?

Frequent flooding, stopping work at the locks and dams and washing away construction facilities, not only delayed completion of the Kentucky River project, it also became a major federal policy issue in the wake of the 1913 flood. Remembered as the "Dayton Flood" because this Ohio city suffered immense damages, the 1913 flood set new records along the central Ohio River, and President Woodrow Wilson ordered the Corps of Engineers to rescue people stranded by the water and deliver emergency supplies to the flood victims. Major Lewis Rand, then managing the Kentucky River project, dispatched the snagboat *Kentucky* downriver for this urgent mission, and it patrolled the flooded rivers from Cincinnati to Louisville. In the flood's aftermath, public opinion urged federal action to alleviate flooding and inspired President Wilson to request comprehensive studies of flood control and water resource development. The Chief of Engineers responded in 1913 by ordering his District Engineers in the Ohio River basin to submit preliminary assessments of the river basins within their purview.¹

Preparing the first comprehensive report on Kentucky River water resources became the duty of Major Lewis Rand and his District staff at Cincinnati and Frankfort. These had hoped by 1913 to have Locks and Dams Nos. 13 and 14 in place and the Kentucky River project completed, providing slackwater navigation on the Kentucky's entire course from its mouth to the Three Forks. When they wrote their comprehensive report, however, unexpected difficulties had interfered with the project schedule, and their outlook for the future seemed gloomy.

In the 1913 comprehensive report on the Kentucky River, Major Rand vehemently criticized the river's slackwater navigation project. Although the project had reached ninety-three percent completion, the use made of the river by commercial transportation was not encouraging. Indeed, the steamboat commerce the project sought to foster was approaching its end. "The glowingly roseate promises for the prospective Beattyville prosperity from its toll of passing and reshipping traffic held out in the original survey," Major Rand observed in his report, "are but little, if any, short of ludicrous." He considered the Corps' 1887 decision to build larger locks than those built earlier by the Commonwealth the most egregious design error, "aside from the error of starting the work at all."²

Major Rand warned that floods had flanked three of the locks and dams on the Kentucky, that the repairs had been costly, and that careful watch was necessary to prevent additional flankings. Expensive project operations and maintenance costs would burden the treasury many years into the future, perhaps forever. Rand also noted that railroads had built tracks into the valuable Three Forks coal fields well beyond the points that slackwater navigation on the Kentucky could serve, and he feared that little coal commerce would travel the river. He saw no reason for spending another cent on the Kentucky's slackwater navigation, although he did foresee a potential for future hydroelectric and flood control development.³

Major Rand's acerbic project assessment may have sprung in part from the troubles he experienced getting Lock and Dam No. 13 into service. Located in a rugged, isolated mountain section, delivering materials and workers there had proven challenging. Contractors failed; subcontractors came and went; and bullets whizzed over the worker's heads while supervisors were driven from their jobs at gunpoint. The Corps had begun construction of Lock and Dam No. 13 in 1909 and had scheduled its completion for 1912, but when Major Rand made his bitter report of 1913 the work was suspended.

The Corps had decided to build Lock and Dam No. 13 under two separate contracts, one for the lock and a second for the dam. In May 1909 it awarded the contract for constructing the navigation lock to Smith, Towles and Company of West Virginia for \$272,960. This firm straightway went to work, built a temporary workers camp named Thirteen, Kentucky, and performed well, completing the lock by August 1911. With lock masonry progressing satisfactorily, the Corps in October 1910 awarded the second contract for building the concrete dam to W. F. Garretson Company of Cincinnati for \$162,795. Garretson's job involved placing concrete in ten adjoining sections called monoliths to form the dam and installing steel trestles atop the concrete to become the movable dam crest. After numerous delays, Garretson Company had only two of the ten concrete monoliths completed when the company failed in 1912. Forfeiting Garretson's contract, Major Rand called on Citizens Trust, the bank that issued the contractor's performance bond, to pay the penalty. When Citizens Trust offered to finish the dam instead of paying the penalty, however, Rand accepted its offer and ordered the bank to finish the dam by August 1913.⁴

Cofferdam construction at Dam No. 13 in Nov. 1912.



Building forms for a concrete monolith at Dam No. 13 in Aug. 1914. The derrick and bucket is placing earth to raise the temporary cofferdam.



The concrete monoliths of Dam No. 13 were partly completed in Oct. 1914.

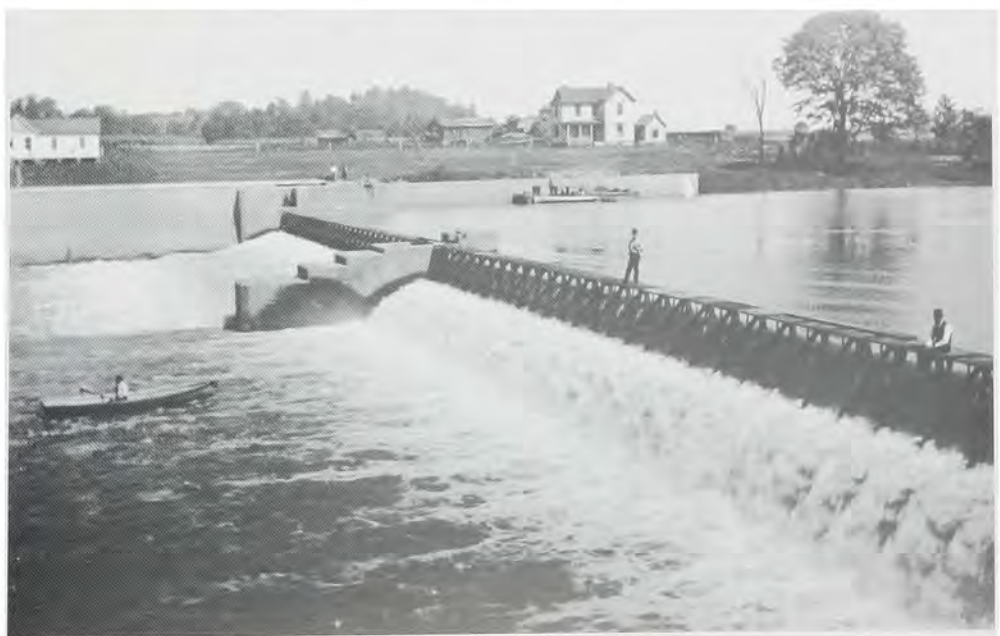


The maneuverboat is lowering the movable crest atop Dam No. 13 because the river is rising.

Metal trestles for the movable crest of Dam No. 13 are in place in Nov. 1914. A drift is at the left and a needle flat for maneuvering the trestles is at the right. Note the three lockhouses in the background.



Citizens Trust bank first subcontracted completing Garretson's contract at Dam No. 13 to the company that had already contracted to build Lock and Dam No. 14. Bank president W. G. Peterkin thought the contractor starting at No. 14 had a vested interest in completing No. 13, because it would create slackwater for delivering equipment and materials upstream to No. 14. Soon after taking over Garretson's job, the new subcontractor complained it lacked funding and stopped the work, and Citizens Trust endorsed \$10,000 worth of loans to get the job moving again. After exhausting this credit, the subcontractor ceased work altogether and demanded that Citizens Trust renegotiate the subcontract on more favorable



Movable crest and walkway across the dam are in place in this view.

terms. President Peterkin of Citizens Trust agreed forthwith, provided that the subcontractor repaid its \$10,000 worth of loans on time. When the subcontractor did not repay those loans and lending banks instituted suits to recover the money, the entire arrangement collapsed and the second attempt to finish Dam No. 13 ended with nothing substantial accomplished. To top this financial disaster, a flood in 1913 washed away the cofferdam around the concrete monoliths, forcing its reconstruction in 1914.⁵

After futilely searching for another subcontractor to finish Dam No.13, Citizens Trust obtained permission from Major Rand to recruit workers and finish the job on its own. The bank dispatched agents to Winchester to employ more workers and hired a construction superintendent. This new superintendent, however, somehow made an enemy of a mountaineer living in the vicinity, who vowed that the superintendent would either leave Thirteen or die.⁶

After the mountaineer had threatened the superintendent at gunpoint, bank president W. G. Peterkin visited the mountaineer's cabin in hope of amicably settling the dispute. Afterwards he told Major Rand that this mountaineer was "one of the typical bad men of the eastern Kentucky mountains. He always packs around a couple of guns, which he seems to use indiscriminately when drinking, which is not infrequently. He has the whole community terrorized, and most people from the sheriff down, give him wide berth."⁷

While the mountaineer had courteously laid his artillery down on the table during the interview, the banker could not reason with him. With guns in hand, the fellow subsequently returned to Dam No.13 and drove the superintendent and office engineer off the job. Work paused again while Peterkin located a man with long experience building mountain railroads who was willing to risk taking the superintendent's job. "Conditions have been such up to this time as to make it impossible to push it," Peterkin advised Major Rand, "because we were entirely unable to get suitable men to go there, or stay there when they got there, but we have every indication now that we have the difficulty solved."⁸

The difficulty, unfortunately, was not solved. At the Dam No. 13 work site, bullets flew overhead at night, one passing through the engineering office without hitting anyone. The Corps inspectors trying to flag down the night train to Beattyville had their lantern shattered by a gunshot. Everyone knew who was terrorizing the workers, but no one could prove it. When even the laborers at the dam asked for their pay to depart for safer jobs, Peterkin and Citizens Trust employed Proctor Pace as the night watchman at Thirteen. Because Pace had substantial law enforcement experience in the mountains, the bank asked Major Rand to arrange his appointment as a Deputy U. S. Marshal. Rand and the U. S. Attorney found they could not deputize the watchman as a federal law officer, but they obtained warrants for the mountaineer's arrest. Hearing this, the mountaineer fled into the hills, threatening to return with kinfolk to kill a few workers at Dam No. 13. A few weeks later the dispute ended violently, when the mountaineer and his son were found shot dead on a lonely road not far from Thirteen.⁹

When Citizens Trust at last finished the contract for building Lock and Dam No.13 more than two years behind schedule, its cost had grown to a staggering \$460,000 total, the most expensive lock and dam built on the Kentucky. Major Rand finally opened Lock No. 13 to navigation on November 14, 1914, and only a week later the first boat passed through the lock. While the Corps had averaged completing a new Kentucky River lock and dam every two years from 1901 to 1910, it had taken six years to finish No. 13. With its completion, slackwater navigation had risen to within six miles of Beattyville and the Three Forks coal fields, and only the fourteenth lock and dam remained to finish the project.¹⁰

Congressman Theodore Burton of Ohio, chairman of the House Committee on Rivers and Harbors, earned a national reputation early in the twentieth century for his opposition to "porkbarrel" projects, meaning locks and dams that lacked commercial benefits. In his opinion, Lock and Dam No. 13 was near enough to the coal fields to test the Kentucky River project rationale, and he thought it wise to omit the construction of No. 14 from future congressional appropriations. This omission came to the attention of Kentucky congressmen, notably John Langley, who thereupon attended Burton's House Committee hearings with the draft in hand of a bill appropriating funds to start the construction of No. 14. As was customary, the Chief of Engineers sent the draft bill to his District Engineer in charge of the Kentucky River to request his considered opinion of the proposed appropriation. In reply, the Chief received a terse telegram:

IN MY OPINION CONSTRUCTION OF LOCK AND DAM FOURTEEN, KENTUCKY RIVER, IS NOT ADVISABLE. IT WOULD PROMOTE NO PUBLIC INTEREST IF AUTHORIZED.¹¹

Congress nonetheless approved the construction funding and in May 1911 the District Engineer opened seven bids for building Lock and Dam No. 14 at Heidelberg, six miles downstream of Beattyville and the Three Forks. The low bid of \$311,912 came from Gahren, Dodge and Maltby Company of New York City. Never having heard of this company before, the District Engineer made discreet inquiry and learned that the firm had erected many buildings in New York City and had recently employed F. B. Maltby as its chief engineer. Maltby, formerly an assistant engineer on the Corps' Panama Canal project, had designed an immense mixing and delivery plant for placing concrete in the canal's Gatun Locks and thus seemed superbly qualified for managing the construction in concrete of Lock and Dam No. 14. The District Engineer therefore accepted the company's bid, designating the last day of 1913 as the date for completing No. 14 and thereby the entire Kentucky River slackwater project.¹²

Construction of No. 14 started in 1911 and bogged down in 1912. After work had begun, company engineer F. B. Maltby had some dispute with other members of the firm and left the job, leaving construction management there in shambles. By the scheduled completion date at the end of 1913 the company had finished only forty-seven percent of the specified work. Major Lewis Rand at Cincinnati recommended forfeiting the company's contract, but the Chief of Engineers thought it wise to waive the time limit for a reasonable period. Nevertheless, according to Major Rand, as a result of a "lack of organization," progress at No. 14 did not improve in 1914 and during 1915 debt completely overwhelmed the company, leaving both its labor and materials suppliers clamoring for their pay.¹³

The District Engineer issued a formal notice that the contract would be terminated unless the contractor employed a superintendent with sufficient technical expertise to direct the work, presented a satisfactory construction management plan for 1916, and supplied assurance that the firm had at least \$25,000 in working capital. These conditions the contractor could not meet, and the District Engineer ordered his Assistant Engineer H. G. McCormick at the Heidelberg field office to take control of the job. McCormick seized the contractor's work plant on March 21, 1916, and inventoried the equipment to ascertain rental rates the Corps would pay the contractor. He directed the Corps workboats to steam upriver from the Lock No. 4 depot at Frankfort, employed the additional workers needed, and set out to finish the Kentucky River project "as expeditiously as possible."¹⁴

Launching a barge at marineway adjacent to the Frankfort repair yard at Lock No. 4 in 1923.



The bankrupt contractor had completed eighty-six percent of No. 14, including its lockwalls, abutment, and two of the ten concrete monoliths in the dam when McCormick restarted the job. McCormick and the Corps worked swiftly, and by the end of 1916 they had the dam's concrete monoliths stretched entirely across the river, the steel lockgates swung in their anchorages, and snags and boulders cleared from the slackwater pool spreading upstream into the North, Middle, and South Forks. McCormick installed the lockgate operating mechanisms, and on January 20, 1917, three years behind schedule, the gates of Lock No. 14 opened for commercial traffic, ending the Corps' thirty-seven-year march to Beattyville. Indeed, eighty years had passed since the Commonwealth in 1836 had begun its campaign to extend the benefits of slackwater navigation up the Kentucky to the "inexhaustible" coal resources of the Three Forks.¹⁵



Completed cofferdam at Dam No. 14 with two of the concrete monoliths in place. When the steam pump removes water from inside the cofferdam, building the remaining monoliths will begin.



A ten-inch pump removes water from inside the bank cofferdam at Dam No. 14.

Not including the \$1 million invested in the lower five locks and dams by the Commonwealth of Kentucky before the Civil War, the cost of the Kentucky River project totaled \$4.2 million federal tax dollars, averaging approximately \$300,000 for each of the fourteen locks and dams. Opponents of federal waterways projects gleefully gloated over the Kentucky River as one of the worst "porkbarrel" jobs in American history. The president of the Louisville and Nashville Railway declared the project's costs would have built a fine railroad from the mouth of the Kentucky all the way to its head, and this railroad could have transported coal for twenty-seven cents per ton-mile compared with ninety cents on the Kentucky's slackwater.¹⁶

Railroad executives and other opponents to waterways mentioned the 1878 project cost estimate of \$1 million made by Captain Robert Fitzhugh and compared it with the \$4.2 million actual cost of the Kentucky River project. This comparison suggested a more than three hundred percent cost overrun on the work. Comparing actual cost with their 1898 estimate of \$4.8 million, however, the Corps proudly announced that its engineering efficiency had saved the taxpayers more than \$600,000 in construction costs. Comparing the cost of any project with an estimate made in 1878, nearly forty years before the project was completed, seems patently unfair, especially in view of the technological changes that occurred in both construction and waterways design during the era. The Corps' comparison of the \$4.2 million actual costs with its 1898 cost estimate of \$4.8 million seems more accurate. The amount of benefits accruing from project construction and costs, however, can only be assessed by examining the project's post-construction history.¹⁷



Lock and Dam No. 14 with the village of Heidelberg on the hill behind the lockhouses. Picture taken at extreme low water stage; at normal stages the river flowed over the top of the dam.

When the gates at Lock No. 14 swung open in January 1917, there was no fanfare, no pageant of stately packets and workday towboats winding its way past the Kentucky River palisades upstream to celebrate the occasion. Indeed, Frankfort newspapers, the heirs of Orlando Brown and J. Stoddard Johnston whose unequivocal editorial support contributed mightily to beginning the state and federal slackwater projects, did not even mention that the Three Forks were at last reached in 1917. By coincidence, the day after Lock No. 14 opened, a Frankfort reporter writing a routine human-interest story interviewed an old riverman, who lamented that the formerly bustling Frankfort wharf was vacant. The reporter asked readers rhetorically: "What has happened to the river trade? What has become of the fine floating palaces and large freighters that formerly plied the trade from points on the Kentucky River to New Orleans?" In the reporter's opinion, these losses resulted from a conspiracy by railroads to drive out river competition.¹⁸

Only two of the steamboat packets the Kentucky River project had been designed to serve remained in operation. The *Royal* and the *Falls City No. 2* still steamed upriver in the Frankfort trade in 1917, but they, too, would soon leave the river. Two towboats, the *Nellie Willett* and *Willie B.*, shoved barges of crossties and tobacco, while small gasoline-powered boats towed log rafts and barges of sand and gravel, but few other boats of consequence plied the Kentucky River slackwater.¹⁹



Towboat *Nancy L.* loading coal near Beattyville. (From Frank Dunn Collection, Kentucky Historical Society.)

In truth, steamboat commerce on the Ohio River was in little better shape. Passenger packet service was dying, and 1917 became the nadir of Ohio River commerce when the delivery of Monongahela coal in huge barge fleets down the Ohio ceased. With the First World War in Europe underway and the entry of the United States threatening, armament production at Pittsburgh consumed the Monongahela coal and little went south down the Ohio. Although the Kentucky River slackwater project had its roots in the dreams of Kentuckians that it would permit Kentucky coal to compete with Monongahela coal in the Ohio River markets, even the profitable Monongahela coal trade had ended by 1917 when the Kentucky River project opened to coal commerce.²⁰

No significant coal shipments had descended the Kentucky River from the Three Forks since 1894 when the last coalboats reached Frankfort. For many years, the Barrett Lines with the *Excel* and other towboats had barged Monongahela coal from Cincinnati to Frankfort, where it sold for sixteen cents per bushel. Coal delivered by railroad to Lexington, on the other hand, cost twenty-five cents a bushel. This price differential had prevailed since the Corps reopened the Kentucky River navigation to Frankfort in 1882, and it totaled savings worth thousands, perhaps millions, to the people of Frankfort. A Frankfort newspaper urged that these lower coal prices were "due entirely to the fact that Frankfort has the benefit of river transportation." Doubtless this was true because the Interstate Commerce Commission then monitored railroad rates and mandated lower freight rates where waterways competition was available.²¹

At completion of the Kentucky River slackwater project in 1917, Frankfort was in the throes of an energy crisis, a coal famine. The war had disrupted barge delivery of Monongahela coal down the Ohio, and mobilization for war had overwhelmed America's railroad system. Not enough railcars were in service to meet both military and civilian transportation demands and this shortage delayed coal

deliveries that winter. The price of coal in Frankfort climbed in 1917 to twenty-five cents a bushel, and most homes in Frankfort then burned coal for heat. In this crisis, Frankfort's city government founded a municipal company to sell coal at cost and thereby help prevent the city's poor from freezing during the winter.²²

During this energy crisis, the Corps also had difficulty obtaining coal to fuel its working fleet, and to supply this need while also drawing attention to the Kentucky River project, it loaded 8,500 bushels of coal mined at Beattyville into two barges. The Corps towboat *Gregory* pushed the barges downriver to Lock No. 4 at Frankfort, arriving on February 7 with the first coal ever towed from Beattyville down the Kentucky. Its arrival aroused interest when Frankfort newspapers reported the coal cost only ten cents a bushel loaded on the barges at the Beattyville mines and three cents a bushel for transporting it to Frankfort. This compared favorably with the twenty cents a bushel charged for coal coming upriver from Cincinnati and the twenty-five cents a bushel delivered to Frankfort by railroad. The *Gregory* headed back upstream two days later to bring down a second coal tow for use by Corps lockmasters and workboats.²³

Business soon took closer looks at the Beattyville coal-mining opportunities. John Sample of Madison, Indiana, traveled up the Kentucky to view the "famous Pork Barrel" and the great waste of money it represented. He learned, however, that J. B. Harris of Irvine on the Kentucky had purchased barges and begun bringing coal downriver from Beattyville at a total cost of fifteen cents per ton, compared to the \$1.40 per ton he had paid earlier for coal delivered by rail from Hazard. This neat profit hinted the slackwater project was not a such a waste as reported, Sample admitted, and he urged Madison's chamber of commerce to tap into the Kentucky River trade, running boats to bring out coal and also to sell supplies and hardware in the upper river valley.²⁴

Entry of the United States into the First World War in April 1917 further exacerbated the railcar shortage, placing so great a burden on rail transport that the railway system broke down and Congress seized control of the railroads, nationalizing them during the emergency. As coal prices advanced even higher to meet the fuel needs of mobilization and armament production, mining coal along the Upper Kentucky became financially attractive. Mine owners reopened their old mines and placed new mines in production. By the end of 1917, two towboats had entered the Kentucky's coal trade, pushing barges carrying 60,000 bushels of coal downriver to Frankfort. Patrick Calhoun, Jr., and his associates purchased the towboats *Dixie* and *Harry Raike* used to move the Beattyville coal, and this Kentucky River fleet became the foundation of American Commercial Barge Lines, established by Calhoun in 1927. Later absorbed by the CSX Corporation, this company became one of the largest barge lines on the inland rivers, operating 120 towboats and 3,300 barges during the 1990s but none of them on the Kentucky River.²⁵

During the First World War the Army required the services of all Corps officers for combat and military construction, and the Chief of Engineers in 1917 transferred the administration of all Engineer Districts along the Ohio River to the command of senior civilian engineers. Movable-dam expert Benjamin Thomas became the Cincinnati District Engineer responsible for the Kentucky River and for putting it in shape to support the mobilization effort. At the request of towing companies entering the Kentucky River trade, Thomas in 1918 initiated several improvements at the locks and dams. Towboats pushing barges of coal and crude oil had greater momentum and less maneuverability than steamboat packets and filled the entire river channel at sharp bends. Thomas had more leeway dredged in the channel at bends and extended the guidewalls leading to the lock entrances. He also began installing guardwalls above the locks to prevent tows from



Towboat *Advance* with barges containing 7,000 barrels of crude oil above Dam No. 8 in 1919.

swinging out from the bank, losing control in the current, and wrecking on the dams. Towboat captains found the movable crests atop Dams No.11 through 13 objectionable because it took too long to hoist the movable crests into position; as a result, the proper depth for navigation was sometimes lost, threatening the tows afloat in the slackwater pools. Thomas converted Dam No. 11 to a fixed dam, replacing the Poiree needle crest with concrete, and similar modifications later followed at the upstream dams.²⁶

As these project modifications proceeded, petroleum companies put towboats into operation barging crude oil from the newly tapped oil fields above Lock No. 12 at Irvine to refineries at Louisville and elsewhere. The Kentucky Towing Company, a subsidiary of Aetna Refining Company, began shipping crude oil in October 1918, sending the towboat *Advance* with six wooden barges from Louisville to Carrollton and on to Beattyville. The *Advance* traveled the 255 miles of slackwater in five days and five hours, loaded barges with oil and returned to Louisville. To prevent oil leaks through the wooden tank barges, the towing company stripped joints inside the barges with canvas and with tin outside, and to expand its crude oil shipments it added the towboat *Onward* to its fleet.²⁷

"Navigation on the Kentucky River is developing at a more rapid rate than on any other stream in the Central Division," noted Colonel Lansing Beach, Division Engineer at Cincinnati. "The development of the coal mines near the head of navigation has resulted in considerable movement of coal which promises to assume important proportions," he continued, adding that the discovery of oil near Irvine had also stimulated commerce that "promises to be large and important."²⁸

Disasters in late 1918 and 1919 tarnished these bright hopes for commercial use of the Kentucky. Intense cold in December 1918 froze the entire river with ice up to fourteen-inches thick, and the river closed to navigation. When the ice broke at the end of January 1919 and formed ice gorges, it severely damaged Locks and Dams No. 1 and 14 and nearly destroyed the Corps repair fleet at Frankfort. Moving on down the Ohio River, the ice demolished many steamboats; indeed, afterward, wooden hull steamboats became largely technological artifacts rather than commercial carriers.²⁹

After the Corps repaired its dams and reopened the river, Kentucky River commerce experienced further losses. On April 7, 1919, the *Onward* towing three barges of crude oil hit an underwater obstruction in the pool above Lock No. 8, punching a hole in an oil barge. Starting its pumps, it proceeded downriver and passed through Lock No. 8 to meet the *Advance* towing empty barges. Tying together, the towboats started pumping oil from the damaged barge into an empty barge, when a fire broke out. Quickly the *Onward* and its barges were consumed by flames, a total loss.³⁰

The following October, the steam towboat *Sea Lion* was lost. Owned by Patrick Calhoun, Jr., and the Jett Coal Transportation Company of Carrollton, the *Sea Lion* towed coal barges and lografts from Beattyville downriver. This majestic boat, built in 1880, caught fire and burned four miles downstream of Lock No. 9, another total loss. Because its charred wreck lay at riverside there for years, a tributary of the Kentucky at that point became known as Sea Lion Branch.³¹

After loss of the oil barge fleet, the Great Southern Refining Company built an oil refinery at Pryse on the Kentucky River near Irvine along with pipelines to transport the oil. Texaco bought this refinery and facilities in 1926 and ended crude oil commerce on the river. The loss of this oil commerce was offset, however, by other promising developments. Shipments of fluorspar and calcite from the Chinn mines along the Kentucky near Munday's Landing, a few miles below Lock No. 7, began by 1920; showboats plied the river all the way to Beattyville; and Captain Oliver F. Shearer formed a new towboat and barge line.³²



The Texaco refinery at Pryse shipped petroleum on the Kentucky River.

Captain Shearer began his career rafting logs down the Kentucky in 1895. In 1907 he bought the little gasboat *Belle* and later built the *Bertha M.* at College Hill, using them to tow lografts and excursion-dancing barges along the upper river from Ford. He raised his family aboard the boats; indeed, three of his children were born afloat and four sons became river pilots. With completion of the Kentucky River project in 1917, Shearer purchased the towboat *Estel II* and barges to transport coal from Beattyville to Irvine and Frankfort and fluorspar and calcite from the Chinn mines downriver. Forming Oliver F. Shearer and Sons Company, Shearer eventually acquired a large coal-towing fleet, but moved his operations to the Kanawha River and sold his fleet in 1973 to the American Electric Power Company.³³

Captain Billy Bryant and family brought their showboat *Princess* to the Kentucky River in 1917, pushing it with the towboat *E. F. Jackson* and later with the *Valley Belle*. Bryant usually spent two weeks a year on the Kentucky, presenting one melodrama at ports on the upriver trip, changing the play at Ford or the port farthest upstream, then returning downriver. Audiences packed its 140-seat auditorium at each stop until the late 1920s when competition from motion picture theaters reduced interest in the live performances and Bryant left the Kentucky.³⁴



Bryant's showboat towed by the Valley Belle, shown here at Cincinnati, conducted annual performances at Kentucky River ports.

Although towboating prospered during postwar years, the steamboat packet commerce for which the Kentucky River project had been designed came to its close. The last passenger-carrying packet *Richard Roe*, also named the *Vim*, made its last voyage on the Kentucky River in 1921. A few steamboats continued in service as towboats until the *John H. Soell* of Madison, IN, left the river in 1938, supplanted by gasboats and diesel towboats.³⁵

Public interest arose in 1920 in extending the Kentucky River slackwater farther up the Three Forks into the coal fields; indeed, requests to extend the barreled pork up the Forks had arisen even before Lock and Dam No. 14 was completed. In 1911 Congress had ordered a survey of the North Fork that was assigned to William McAlpine. McAlpine's survey of the stream revealed that about 60 million board feet of logs and crossties still floated down North Fork annually at high water to mills at Jackson and Hazard, and pushboats transported supplies upstream from the railroad terminal at Jackson. A milldam at Hazard even had a crude lock to provide passage for the pushboats. A new railroad under construction from Jackson through Hazard to Whitesburg would soon end all commercial navigation on North Fork, McAlpine predicted, and any improvement to the navigation seemed unnecessary. A similar survey of the South Fork in 1915 found that, while lografts and crossties still floated the stream and pushboats transported supplies from Beattyville to Booneville, this commerce was insufficient to justify the costs of improving navigation.³⁶

The completion of Lock and Dam No. 14, the opening of new mines during the First World War, and the shipments of coal downriver, stimulated revived interest after the war in extending slackwater navigation up the Forks. During the public hearings and investigations of these proposals, the Corps learned that public opinion generally favored the project's extension. Perhaps typical were the comments of a businessman who owned coal and timber lands along the Forks:

I think that anything that would bring transportation into this backward district would do a great deal of good. It is generally believed by people acquainted with the Kentucky mountains that as soon as a railroad gets into a district, feuds disappear and moonshining diminishes. This would apply equally to river transportation. This, however, is only the sociological aspect. I am convinced that a very large supply of good steam and domestic coal could be supplied to Ohio River towns from this source much cheaper than it can be delivered on the railroad. The aspect of river transportation has changed considerably since the rise in railroad freight rates and the advent of the motor truck. Neither a town nor a plant would need to be on the river to get its supply of coal that way, as motor trucks could make the land haul from the river. It seems very foolish to have spent millions in canalizing the Kentucky River through districts that give it little or no business and then refrain from constructing the few miles necessary to connect it with a district that will make it extremely useful.³⁷

Sociological considerations aside, this and similar arguments did not convince the Corps that any benefits would accrue from extending slackwater navigation farther up the Three Forks, and it reported unfavorably to Congress on the proposal. Indeed, the small commerce on the Kentucky River made construction of its locks and dams seem a pyrrhic victory to the Corps.³⁸

Colonel William W. Harts, who as a lieutenant in 1896 first predicted economic failure for the Kentucky River project, returned to the river in 1921 as the Central Division Engineer at Cincinnati. During the quarter century after 1896, he had a remarkable career, serving as military aide to President Woodrow Wilson during World War I, and as construction engineer for the Lincoln Memorial on the Washington, DC, Mall. It gave him no pleasure in 1921 to learn that his economic

analysis of 1896 had proven correct. Looking at the project in 1921, he concluded that federal taxpayers were subsidizing commerce navigating the Kentucky River to the tune of \$2 per ton, amounting to about two cents per ton mile compared with average railway rates in 1921 of only three-quarter cent per ton mile.³⁹

With the Kentucky River project completed, Colonel Harts in 1922 closed the Second Cincinnati District that had managed the project since Captain James Cuyler's arrival in 1880. He consolidated it with the First Cincinnati District that was responsible for the central Ohio River. Assistant Engineer Lucien S. Johnson at Frankfort remained in local charge of the Kentucky River, however, and devoted his attention to the monumental task of operating and maintaining the famous porkbarrel project.⁴⁰

Kentucky River

THE RHINE OF KENTUCKY?

We have seen the Rhine dashing southward, wild and unrestrained, as magnificently grand as it is turbulent; we have seen the Marne stretched across the picturesque landscape of lovely France like a silver ribbon. Yet, in magnificent grandeur and natural beauty none of these are comparable with Kentucky River.

Louisville Times, 1922

Recognizing the potential contributions of recreational tourism to the state's economy, the Commonwealth during the 1920s advertised the Kentucky River with its towering stone palisades as the "Rhine of Kentucky." In the gasoline-powered motorboats and automobiles that became available during the 1920s, tourists enjoyed the river's environmental charms, fostering the development of tourist-service businesses along its course. On the other hand, news reporters and historians also described the river as a commercial "white elephant." How this imposing stream could have been locked and dammed from its mouth to source without major waterways commerce indeed puzzled the tourists who were unacquainted with the project's troubled history.¹

After the First World War, recreational traffic enjoying the river's scenic attractions blossomed as boaters from Cincinnati, Louisville, and more distant ports plied the channel each year from May to October. Boat clubs, camps, and cottages sprouted at riverside to serve people who came to swim, fish, and participate in aquatic sports. For several reasons, however, the Corps of Engineers discouraged recreational activities at the Kentucky's locks and dams. It made no significant effort to support recreational use of the "Rhine of Kentucky" until the Depression eroded the river's commercial traffic.

Post Office and St. Clair Street Bridge during the 1937 flood at Frankfort.



The Corps endeavored to operate and maintain the Kentucky River navigation during the 1920s at the lowest possible cost, while also encouraging the commercial transport of coal, minerals, sawlogs, and crude oil on the river. The promising trade in these commodities of the 1920s gradually faded, however, as the producers depleted the oil, minerals, and coal nearest the river and cut out the forest. River commerce declined sharply with the onset of the Great Depression of the 1930s and the remaining commodities moved to markets in pipelines and on railroads, leaving the river nearly destitute of traffic by the end of the Depression. The Corps then considered closing the locks, at least on the river's upper section, but energy shortages during the Second World War temporarily revived commercial use of the river.

Between the two world wars, interest also arose in the Kentucky's hydroelectric power, water supply, water quality, and flooding. A public utility company developed its hydroelectric power during the 1920s, and after the record drought of 1930 many cities tapped the river as an emergency water source. Concerns about pollution led to the first federal studies of the river's water quality in 1937, and record floods in

1937 and 1939 resulted in Corps studies of flood control reservoirs and other flood protective measures. Before reviewing these multipurpose studies, a glance at the locks and dams and their operation during the 1920s is instructive.

Colonel Harts, the Central Division Engineer, accompanied by the Cincinnati District Engineer and Assistant Engineer Lucien S. Johnson, inspected the Kentucky River project from Beattyville to Frankfort in 1921 and penned a highly critical account of its condition. It was Colonel Harts' first return visit to the project since 1896, when he had predicted that building locks and dams upstream of Lock No. 8 would have little or no economic value. He considered it his duty to identify project flaws and order them corrected, and his 1921 report led to several project modifications and also affected his career adversely.²

Descending the river, Harts saw that the movable A-frame crests installed atop Dams 14, 13, and 12 had proven unsatisfactory and were seldom used. Because operating the movable crests required three men, the Corps had built three lockhouses at each lock for the three-man crew and this seemed a waste. Although Harts found the steel lockgates at these three structures in excellent condition, their concrete lockwalls had already deteriorated as a result of water entering cracks and freezing during winter. Water falling eighteen-feet over the dams also had eroded riverbanks below the dams, but he thought this condition would stabilize and not undermine the dams if the banks were armored with riprap stone. He observed that No. 11's steel and concrete were in fine condition, but the concrete paving behind the lock was disintegrating. In his opinion, the hand-placed cobblestones used as paving behind the older locks had withstood deterioration better than the concrete paving.³

With regret, Harts reported that the flanking in 1905 of Nos. 10 and 9 had caused operational problems. No walkways then existed across the auxiliary dams connecting the riverbank with the locks, and the lockmasters had to row boats out to the locks to operate them. When Harts complained of rust on the steel lockgates and deterioration of the concrete, Assistant Engineer Lucien Johnson, in direct charge of project maintenance, promised immediate correction of this decay.⁴

Although the Corps was then replacing the old wooden with steel lockgates as the old gates deteriorated beyond repair, Harts saw that Lock No. 8 still had wooden gates when he inspected it in 1921. In 1896 Harts had designed the stone masonry lockwalls at No. 8, and he admitted that his selection of Bedford limestone as facing for the lockwalls had been unfortunate. In freezing weather this soft stone broke, dropping slabs into the river and leaving unsightly holes in the lockwalls. He found similar regrettable conditions at Lock No. 7, but he noted that the sites he had selected for Locks Nos. 8 and 7 were superior to those at the upstream locks because the approach of boats to his locks was "exceptionally good in both directions."⁵

At Lock and Dam No. 6, the first built on the river by the Corps, Harts saw that it was in the best condition of any lock on the river. Here, however, the District Engineer had approved a change in the lock-operating mechanism from the traditional steel rack-and-pinion system to a strut and wire cable system, and Harts thought this system entirely unsatisfactory. He ordered the District Engineer forthwith to switch it back to the traditional system.⁶

Descending to Lock No. 5, Harts saw that the narrow 38-foot width of this older state-built lock restricted the descending traffic that had passed through the 52-foot wide locks upriver. Two commercial barges could lock simultaneously at the upstream locks built by the Corps, but only a single boat could pass through Lock No. 5. This same restrictive width prevailed at Lock No. 4 and the downstream locks, but Harts did not broach the subject of rebuilding and widening the older locks; their narrow width seemed more than adequate for the existing commerce. He saw that Lock No. 5 had steel lockgates at its upper end and wooden gates at its lower end,

while Lock No. 4 still had wooden gates. In his opinion, these rotten wooden lockgates would require replacement within two years.⁷

Harts ended his river inspection at Lock No. 4 and the adjacent repair station and project office. Here, Assistant Engineer Lucien S. Johnson, Superintendent C. H. McCrackin, and Clerk Albe G. Barrett provided local project administration. Reporting to the Cincinnati District Engineer, Johnson managed the project and provided engineering services. McCrackin supervised the lockmasters and maintenance crews, and Barrett handled finances, payroll, correspondence, and reporting. Harts inspected the Kentucky River repair fleet anchored at the lock and work

underway in the machine and carpentry shops and at the new marine ways where workboats and yawls were built and repaired. He noted the buildings in the repair yard were of durable concrete-block construction, but he complained that the imitation rock face applied over the blocks produced a poor appearance.⁸

Harts ended his inspection report with the comment that river commerce had averaged only 187,839 tons annually during the previous decade and that this small tonnage moved on the river at an average cost to taxpayers and consumers of two dollars per ton. When Harts made similar critical reports on the Big Sandy,

Muskingum, and other waterway projects on Ohio River tributaries, the Chief of Engineers soon heard a chorus of complaints from Congress that Harts was "prejudiced against internal waterways and was knocking river improvements." Harts departed Cincinnati and the Kentucky River late that year, spending his remaining career on military projects.⁹

During the postwar years, Kentucky River project operations suffered a plague of accidents and disputes. Swift floods out of the Three Forks often damaged the movable metal crests originally installed atop the concrete dams at sites above No. 11. The floods brought down logs and drift that bent the metal trestles beyond repair. A sudden flood in October 1919 had even washed the Corps maneuverboat over the top of Dam No. 12, fortunately without loss of life. Also in 1919, while repairing Lock No. 9, Corps overseer Ernest Bentley died when construction equipment collapsed on him; and in 1920 Assistant Lockmaster R. H. McPherson in a small boat went over Dam No. 7 into the turbulence below and drowned. Service on the Kentucky was hazardous indeed until the Corps instituted intense attention to occupational safety during the 1930s.¹⁰



Powerhouse and machine shop at the Frankfort repair yard adjacent to Lock No. 4.

Lock force attending a first-aid class at Lock No. 4 in Mar. 1939. From Left, the four kneeling are Rowland Johnson, James Eversole, Edgar Baker, Sidney Conway. Standing from left, John Withrow (clerk), Huber Hunter, Charlie Freeman, John Aubrey, William Simpson, Earl Cox, James Boggess, Albe Barrett (accounting clerk).



Recreational boating became a significant segment of Kentucky River traffic during the 1920s. The Commonwealth advertised the river, because of its lofty stone palisades, as the "Rhine of Kentucky," comparing it favorably with that and other European scenic rivers and with New York's Hudson River. No river surpassed, said the state's tourist bureau, the grandeur and natural beauty of the Kentucky River.¹¹

Wealthy boaters owning large recreation craft made annual pilgrimages from Cincinnati and Louisville up the Kentucky, usually to Boonesborough. To serve this burgeoning recreational traffic, boat clubs formed at Clifton, Boonesborough, and other ports in addition to the older Frankfort boat club founded by J. Stoddard Johnston during the 1860s. The Kentucky Progress Commission touted recreation for tourists on the Kentucky, and the Governors began appointing Kentucky River Admirals, matching in prestige the honorary Kentucky Colonels appointments. Some tourists and many Kentuckians built private camps and clubhouses along the river to take advantage of fishing and scenic boating opportunities. "The stream is filled with pleasure motor craft during the summer months," a newspaper reported in 1923, adding: "A motorboat trip up the Kentucky River is a rare scenic treat, and more people are taking advantage of such an outing."¹²



The Mayo brothers of Mayo Clinic used the *Minnesota* for river recreation and had an automobile aboard for tours after landing at Frankfort. (From Historic Frankfort, Inc.)

Commercial boats always took precedence at the Corps locks, however, and pleasure seekers in boats waited their turn for lockage. While they waited, they read the bold signs prominently displayed by the Corps at the locks: NO SMOKING, OPEN LIGHTS, BATHING, FISHING, LUNCHING. U.S. ENGINEERS. The prohibition against lighted tobacco and lanterns at the locks was a necessary safety precaution: barge tows of oil and gasoline then plied the Kentucky and some had caught fire and burned. The Corps had imposed the other restrictions, however, after several unpleasant, indeed nasty, experiences with public recreation near the locks.¹³

Fishermen and their families flocked to the dams, the fishermen for piscatorial pleasures in turbulent waters at the dams and their families to enjoy the park-like atmosphere at the locks and the beaches created by the hydraulic action of the dams. Sometimes this ended with raucous parties disturbing the lockmasters' families living at the locks. Property vandalism became so extensive that lockmasters spent their summer weekends guarding the locks. After many rowdy incidents and several drownings at the locks, the Corps prohibited fishing and swimming at the locks and picnicking on the lock reservations.¹⁴



Boonesborough Beach and Ferry on July 25, 1920, with Lock and Dam No. 10 in the background.

Shakers Ferry in 1912 with a recreation craft moored downstream. (From R. C. B. Thurston Collection, The Filson Club.)



SUNDAY RIVER EXCURSION

First excursion of the season on Barge *Summer Girl*. Boat leaves at 10:45; returns at 5:30. Fare 40 cents.

11-3t CHARLES ARMSTRONG.

Charles Armstrong at Frankfort operated the excursion barge *Summer Girl*, towed by the *Clarence*. (From *State Journal*, July 11, 1919.)

The prohibition against swimming at the locks originated in protests from boat captains. Until the 1930s, Captain Charles Armstrong and his towboat *Clarence* towed the *Summer Girl* and other excursion-party barges from Frankfort up to the scenic palisades on regular summer schedules, and several captains operated smaller excursion barges out of Shaker Landing and High Bridge through Lock No. 7. These captains complained to the Corps of indecently clad swimmers who often frightened the excursion passengers by pretending to fall off lockwalls into the river, resulting in screaming and panic aboard the boats. This prank damaged the river business by deterring the timid from purchasing passage on the excursions. These protests against swimming at the locks went to Washington headquarters, where the Secretary of War determined that "forbidding bathing and fishing in the vicinity of the locks is deemed essential to the proper administration of the locks and dams."¹⁵

Always delayed at the locks while commercial traffic took precedence, recreational traffic sometimes suffered extended delays for other reasons. During summer recreation seasons, the lockmasters and their assistants were busy with painting, mowing, and routine project maintenance, and the roar of water falling over the dams impaired their hearing. Often they did not detect the arrival of small recreation boats at the locks until the boaters rang the warning bells placed on the lockwalls for the purpose. By the time lockmasters reached the locks, the boaters often had become upset and showered verbal abuse on the lockmasters. The noise of water over the dam usually obscured these epithets, and the lockmasters concentrated on passing the boats on their way and out of earshot. In rare instances, however, these incidents escalated to violence, and in one notable case culminated with murder.

Lockmaster Mark Spence managed Lock No. 7 in sight of High Bridge and Shaker Landing during the early twentieth century. At dusk one January evening, Spence heard the warning bell calling for lockage, ran to the lock, and found a



Each navigation lock on the Kentucky River had a bell for boaters to call the lock operator.

boater in a small craft awaiting passage. Spence opened the upper lockgates for the boat to enter the chamber, then closed them behind the boat and started down the lockwall to open the lower gates. From inside the lock, the boater suddenly raised a gun and began firing. As Spence ran down the lockwall he was hit in the arm and stomach. The boater continued shooting as Spence crossed the lower lockgates and ran toward the lockhouse, calling for his wife to bring his gun. Spence collapsed as he reached the lockhouse, the boater hurriedly departed the scene, and a few days later Spence died of his wounds.¹⁶

Charles McKee, the assistant lockmaster, called law officers, whose investigation revealed the boater had a lengthy record. Convicted for manslaughter ten years earlier and sentenced to twenty-one years, his sentence had been reduced by the Governor to three years and he had been released on parole after eight months. In an earlier incident at Lock No. 7, he had pelted the lockmaster with rocks and Spence had him arrested. The county court had tried the boater for assault and convicted him, but fined him merely one cent, making it evident that the boater, a member of a prominent Kentucky family, had influential friends. Because neither county nor state law officers arrested the boater for Spence's murder, the officer managing Kentucky River operations feared another "travesty of justice" in local courts. He urged the Chief of Engineers to initiate prosecution under federal law and delivered the evidence to the U.S. Attorney for Eastern Kentucky.¹⁷

Declaring the lockmaster's murder a "most willful and malicious act, not the remotest reason existing for the homicide," the U.S. Attorney had the boater arrested by federal authority and jailed without bail. Noting the boater had friends who might intimidate witnesses, he assigned a Secret Service agent to monitor the case and prevent a perversion of justice. In the U.S. District Court's preliminary hearing, the boater's attorney sought a change of venue to state courts, arguing that the federal title to Lock No. 7 was improper. During the ensuing legal tangle, the District Engineer at Cincinnati pressed for swift prosecution: "The crime was committed against the person of an employee of the Engineer Department, while in the discharge of his duty, on land owned by the United States," the District Engineer asserted, concluding: "It is desirable, not only for safeguarding the dignity of the general government, but for the future security of its employees in the same locality, that the criminal should not escape his due punishment."¹⁸

After the U.S. Attorney had retrieved and supplied title documentation for Lock No. 7 to the court, the presiding judge sent the case to trial at the U.S. District Court in Covington, Kentucky. After hearing the evidence, the jury traveled to Lock No. 7 to personally view the crime scene; it considered the evidence at length, and then convicted the

boater of murder. Apparently to reduce the influence of the boater's prominent friends over his disposition as a convict, the court sent the murderer to an out-of-state prison far from the Kentucky River.¹⁹

Although Kentucky River lockmasters saved many recreational boaters who lost control of their boats and were about to smash over the dams, or recovered the bodies of those they could not save, the Corps persisted in its restrictive policies against recreational activities. Indeed, the Corps made no significant effort to enhance growing recreation traffic on the Kentucky until 1936, when Colonel Roger G. Powell, the first Ohio River Division Engineer, directed that pleasure boats as well as commercial traffic should be encouraged. Powell ordered that no locks be closed to navigation from May 15 to October 15 of each year except for repair emergencies and then only on express written authority from him. When it became necessary to repair the locks during the recreation season, Powell directed that the repairs should proceed on an around-the-clock schedule seven days a week.²⁰

Maintaining the Kentucky River project was no less challenging than its operations. Like the Commonwealth's Board of Internal Improvement before the Civil War, the Corps suffered occasional maintenance disasters. A 1919 flood swept away the lower lockgates of Lock No. 1, and after the gates had been restored another flood in 1920 again wrecked the gates. Engineer Lucien Johnson, then in charge of project maintenance, noted the lockgates were opened wide and latched against the lockwalls at the approach of a flood, but after studying Lock No. 1 he ordered the lockgates left closed and fastened together during flooding. Although this modification ended the loss of lockgates to flooding, it did not prevent damages from other causes.²¹

The Corps nearly lost a lockgate at Lock No. 12 in 1925, when Lockmaster Walter P. Bush locked the towboat *Plymouth* with empty oil barges upstream at night. A deckhand tied a cable from the lockwall to a barge deck instead of its bow, and as the lock chamber filled with water the barge's bow went under the lockgate frame. In the midnight dark, Lockmaster Bush did not see this mistake, and by the time he saw the gate rising the barge had hoisted it seven feet above its anchorage.²²

Receiving news of the accident at Frankfort, Lucien Johnson straightway ordered the repair fleet at Lock No. 4 to steam upriver toward Lock No. 12 while he motored on ahead to plan the emergency repairs. Reaching No. 12, Johnson lashed lines to the lockgate to prevent it moving to the side and enlisted help from Oliver Shearer and his towboat *Estel II*. By using the boat's pumps to fill the empty barge with water, Johnson slowly sank the barge, thereby lowering the lockgate back onto its anchorage without damage. Then he had the water pumped from the barge to raise it and completed the repairs before the Corps work fleet arrived at the scene.²³



A barge towed by the *Plymouth* accidentally lifted a lockgate at No. 12 in March 1925.

Although sometimes disrupted by emergencies such as that at Lock No. 12, an annual maintenance schedule developed on the Kentucky. Early each year, Lucien Johnson and Superintendent Samuel Eversole, sometimes accompanied by the District Engineer, boarded a fast launch and boated upriver to Beattyville to plan the year's work. At each lock, they conferred with lockmasters to list needed repairs to the lockgates and lockhouses. The engineers inspected the dams' structural conditions, sending diver Curtis Leitch underwater with an ice pick to probe the timbercribs and determine whether they were solid or spongy from deterioration. They listed the snags in the channel and sounded the lock approaches and channel to determine where dredging was necessary. Returning to Cincinnati, they sent their yearly maintenance plan to the Chief of Engineers for approval, and then dispatched the repair fleet upriver in April to start the work.²⁴

Consisting of the snagboat *Kentucky*, dredge *Carrollton*, and the towboat *Gregory* or *Burnett* pushing derrickboats, barges, and quarterboats to lodge the workers, the Kentucky River repair fleet steamed upstream each spring, removing obstructive snags and dredging the lock approaches and navigation channel. Once the fleet reached Beattyville, it turned and started back downriver, making structural repairs to the lockgates and dams as it descended to Frankfort and on to Cincinnati. As the project aged, the cost of this annual maintenance work grew, passing \$100,000 and climbing by the end of the 1920s toward \$200,000 annually.²⁵

While the Corps wrestled with maintaining the navigation project, public utility companies developed the Kentucky's hydroelectric power. Organized at Lexington in 1912, the Kentucky Utilities Company expanded electric-power services throughout the state during the 1920s and it sought additional power sources. To supply the growing demand, in 1923 the company began construction of a hydroelectric dam on the Dix River, which enters the Kentucky River near High Bridge and Lock No. 7. Completed in 1925, the immense Dix River Dam was the highest rockfill dam in the world, impounding the deep and 36-mile long Herrington Lake. Water from the lake turned three turbogenerators in a powerhouse below the dam to help supply the Commonwealth's mushrooming demands for electricity.²⁶

After completing the Dix River Dam, Kentucky Utilities Company took options for developing hydroelectric plants at all fourteen navigation dams on the Kentucky and also at a site on the South Fork near Booneville. It exercised its option only at Lock and Dam No. 7, where both the releases from Dix Dam and the Kentucky's normal flow could be converted into electric power. In 1928 it installed three turbines at Dam No. 7 and connected them to generators in a powerhouse standing on piers over the dam. For us-



The dining room aboard a quarterboat on the *Kentucky* in 1910. At isolated construction sites, workers living aboard quarterboats enjoyed family visits.

Corps towboat *Lucien Johnson* pushes a shopboat and quarterboat up the *Kentucky* in 1934.



Kentucky Utilities powerhouse and transformer platform built at Lock and Dam No. 7 during the 1920s.

ing Dam No. 7, the company paid a \$4,400 annual fee plus a surcharge on the power production, which together with power from Dix River Dam and new coal-fired steam electric plants, allowed the company to extend electric service to 236 additional Kentucky communities.²⁷

These and similar hydroelectric plants built throughout the nation aroused public interest, and Congress in 1927 directed the Corps of Engineers to report on potential hydroelectric, navigation, and flood control developments on the Kentucky and many other rivers. Completed in 1931, the Corps' report on the Kentucky examined three potential dams and reservoirs for flood control and power production at the Laurel Branch, Buckhorn, and Booneville sites located respectively on the North, Middle, and South Forks upstream of Beattyville. It also contemplated modernizing Kentucky River navigation by raising Dams Nos. 3, 5, 8, 11, and 13, removing Dams Nos. 4, 6, 9, 10, 12, and 14, and building a new dam to replace Dams Nos. 1 and 2. By reducing the number of dams on the river from 14 to 6, longer and deeper pools could be established for improved navigation and for hydroelectric power production at the dams. The minimum depth for navigation would be increased from six feet to nine feet to match the depth available on the Ohio River, and lock capacity would be quadrupled through construction of new locks with the 56-foot width and 360-foot length standard on the Kanawha River and other tributaries of the Ohio. The Corps expected that coal shipments would become the principal commerce on the modernized river, but it determined that these would be insufficient to justify the costs of modernization. It therefore recommended deferring action until regional commercial transportation and hydroelectric power demands justified the investment.²⁸

The 1931 Corps report paid scant attention to the Kentucky River water supply, water quality, and flood control problems made apparent during the disastrous 1930s. Severe droughts had afflicted the Kentucky River region in 1795, 1855, 1888, and 1925, but the prolonged drought of 1930 dramatically revealed the precarious water supply of central Kentucky. For a record 205 days during 1930, the Kentucky River flow at Frankfort was less than 500 cubic feet per second. Before the drought ended, evaporation and leakage depleted the river's navigation pools, and tank trucks hauled Kentucky River water from Frankfort to Shelbyville and other communities to avert complete water famine.²⁹



Washing clothes on river bank at Clear Creek to conserve water in well and cistern.

Farmers draw water from the river near Gest and Lock No. 2 during the 1930 drought.

Frankfort, Irvine, Beattyville, and other riverside communities had long obtained their water from the river, and after the 1930 drought other cities built plants to draw water from the Kentucky. When Winchester, Lexington, Versailles, Richmond, and Lawrenceburg tapped into the Kentucky River for emergency water supplies, it became increasingly apparent that population growth and industrial development in these communities might eventually consume the entire flow of the Kentucky during droughts as prolonged as that of 1930.³⁰

Equally important to future water supply were growing concerns about the Kentucky's environmental water quality, emanating mostly from the promoters of Kentucky's scenic tourist attractions. These noted that the sources of the Kentucky River served as a sewer and dump. "It flows through, over, under tin cans, fragments of abandoned automobile bodies, boxes, barrels and all of the offal of a sturdy civilization which is more concerned about other things than about the appearance of a stream which a freshet may swell to such volume that it will carry from the scene of its dumping a good deal—never by any means all—of the refuse that is heaved into it." They warned also that rock quarrying and highway excavation along the lower river, especially at Frankfort, denuded the hills of their timber, flowering shrubs, and wildflowers. "Uglification is reckless" along the river, they warned, forecasting that it would threaten the scenic environmental attractions for tourists. Some urged that the river should be declared a national playground to preserve it so future generations might know what the Kentucky "looked like when the hardy pioneers used it for a thoroughfare for their frail canoes."³¹

In cooperation with the U.S. Public Health Service the Corps participated in the first federal survey of Kentucky River water quality in 1937. This survey revealed that most urban areas along the river had inadequate sanitary sewers and treatment plants. The principal industrial waste load in the water came from discharges by the nine whiskey distilleries along the river and from acid water drainage from coal mines along the Three Forks. The report also noted, however, that the distilleries were taking measures to control their effluents and that federal agencies had funded programs to seal abandoned coal mines.³²

Deteriorating water quality also concerned Corps operating and repair forces working in close contact with the river. By the 1930s, the Corps had difficulty recruiting the mill-wright carpenters who fabricated the heavy timbers used in



Log raft in the river at Irvine in 1930. The conveyor in left foreground took the logs up to the saw mill.



No water passed over Dam No. 7 during the 1930 drought. Structure on the right is the Kentucky Utilities powerhouse.



Corps repair crew and derrick replacing a lockgate at No. 5.

wooden lockgates, miter sills, and timbercrib structures: few carpenters with these skills remained in business, and these were reluctant to work in the Kentucky River water. In addition, the acidic water rapidly corroded the steel lockgates and appliances at the locks.³³



Boating on Broadway in front of the Old Capital Building on Jan. 23, 1937. Stage was a foot below the 1937 crest.

To protect the steel lockgates from acid corrosion, the Corps' maintenance force applied paint and other coatings, but they made no attempt to save the steel A-Frame crests atop Dams Nos. 12 and 13. When these were raised in 1933, their metal parts had corroded to half their original dimensions, and the Corps' maintenance crew removed them from the dams. They stored the metal crests at the Lock No. 4 repair yard until 1942, then sold them as scrap metal in support of wartime mobilization.³⁴

Record floods in January 1937 and February 1939 cleaned the debris of civilization from the Kentucky and doubtless temporarily improved its water quality. The 1937 flood climbed to a 47.6-foot stage at Frankfort, inundating seventy percent of the community and making refugees of two-thirds of its population. Highway, railroad, and public utility services were disrupted and business suspended, contributing to flood damages estimated at \$1.5 million. The flood inundated communities along the lower river as well, and a Pan American express train marooned by flooding at Worthville became emergency housing for flood victims. Although the 1937 flood caused few damages upstream of Frankfort, in February 1939 a flood from the Three Forks put eight feet of water into Beattyville, causing immense damage there.³⁵

These disturbing flood damages along the Kentucky spurred action in Congress, which directed the Corps to study potential flood control projects in the basin. In response, the Corps reported favorably on sites for flood control dams and reservoirs at Buckhorn on the Middle Fork and at Booneville on the South Fork. These could reduce flooding along the Forks and at Beattyville, but their reductions of flooding at Frankfort measured in inches and flood protection there had to be measured in feet. To provide measurable reductions in Frankfort's flood levels, the Corps proposed a high dam on the Kentucky's main stem near the mouth of Jessamine Creek. Called the Jessamine Creek Dam, this 148-foot high dam would have submerged 21,500 acres of the Kentucky valley and ended navigation on the river upstream of Lock No. 7.³⁶

Loud public protests greeted the Jessamine Creek Dam proposal. Rivermen urged that navigation on the upper river should be preserved, and historical associations lamented that its reservoir would inundate historic Boonesborough. As a result, Congress never funded this dam and efforts began to protect Frankfort through the construction of levees and floodwalls along the city's riverfront. Indeed, the first short barrier levee was constructed by the city itself after the 1937 flood to protect its Holmes Street and Thorn Hill sections from backwater flooding. Under authority of the 1938 Flood Control Act, the Corps cooperated with the city by installing a flood gate in the levee, completing it in February 1941 and

testing it during a 1942 flood. This was the first flood protection project completed with federal cooperation in the Kentucky River basin.³⁷

"The Kentucky River is one outstanding case of costly improvement of a stream that practically was abandoned as soon as it was made navigable," declared reporter W. S. Kaltenbacker in 1928: "In a navigable way, it often has been referred to as a white elephant." With the onset of the Great Depression during the 1930s, commercial navigation on the Kentucky nearly died. Crude oil shipments from the Irvine field ended in 1931; coal and lumber shipments from the Three Forks and mineral shipments from the Chinn mines ceased. Commerce on the river declined by half from its 300,000 tons peak in 1922 down to 150,000 tons in 1935 and this was mostly sand and gravel and coal ascending from the Ohio River. Sometimes months passed between lockages of commercial craft on the upper river.³⁸

As commerce dwindled, the Cincinnati District sought to reduce maintenance costs, deferring major repairs and concentrating available funds on the lower river where some commerce continued. Rather than dredging gravel bars forming in the river upstream of Lock No. 8, the Corps merely marked them with buoys warning recreation craft to stand off until the repair party made its annual spring pilgrimage to Beattyville. It mothballed its expensive snagboat *Kentucky* and instead used small craft to remove obstructive snags. It closed its marine way, boatyard, and suboffice at Lock No. 4, and moved the Kentucky River repair fleet's headquarters to Saylor Park (Lock and Dam No. 37) on the Ohio River near Cincinnati. It reduced the number of operators at Locks Nos. 13 and 14 to one lockmaster and would have done the same at downstream locks if safety considerations had not prevented it. From nearly \$200,000 yearly, the Corps reduced annual maintenance expenditures to less than \$100,000. When these cutbacks caused rumors in 1932 that the Corps would close the Kentucky River locks, Colonel C. Lacey Hall, the District Engineer, responded: "There is no possibility of navigation ever being abandoned on the Kentucky River."³⁹

Yet, by 1936 Colonel Hall proposed suspending operation of the Kentucky's locks entirely. The Division Engineer disapproved of Hall's recommendation, however, pointing out that commerce was reviving at the old steamboat locks on the Cumberland River in western Kentucky and suggesting a similar revival might occur on the Kentucky River. Besides, he told Hall, "an attempt to abandon a stream in this division will arouse a certain amount of opposition in Congress."⁴⁰

As the Division Engineer predicted, a small upswing in Kentucky River commerce began in 1936 when the Gulf Refining Company opened terminals at Frankfort and Camp Nelson, chartering the towboats *R. W. Turner*, *Bob Gresham*, *J. J. Kelley*, and *Hardy L. Roberts* to push barges of gasoline upriver to the terminals. This traffic had an inauspicious start when the captain and crew of the *Hardy L. Roberts* came off the broad Ohio and charged up the smaller Kentucky, ignoring directions from the Kentucky River lockmasters. Neglecting to put out lines as instructed to check barge movements inside the lockchambers, the towboat struck and chipped the old stone-masonry lockwalls. After a warning from the Corps that the lockmasters had "considerable more experience with Kentucky River locks than deckhands making their first trip through these locks," the boat owners promised to use more care in the future in lieu of paying damages. Barging gasoline up the Kentucky continued through the Second World War, and became vital during the wartime gasoline rationing and energy shortages.⁴¹

As the entry of the United States into the Second World War approached, the Kentucky River lockmasters received a mysterious message. A tip from the Federal Bureau of Investigation warned of a possible attempt to sabotage navigation locks, and in response the lockmasters closed the lock reservations to the public and employed night watchmen at the locks and dams. This probably originated in events far from the Kentucky River. When German submarines sank American tanker ships, causing petroleum shortages along the Atlantic coast, the Corps of Engineers sought to alleviate this by barging petroleum up the Mississippi and Ohio rivers; and the FBI captured German saboteurs landed from a submarine and found on them plans for locks and dams. Whatever the tip's source, the scare soon ended, and no attempts to sabotage the Kentucky's locks are mentioned in public records.⁴²

When the United States entered the war in December 1941 the Kentucky River navigation was closed, not by sabotage but by ice. The cold reached minus sixteen degrees on Lock No. 4's thermometer on January 8, 1942, surpassed only by the seventeen degrees below zero recorded on December 11, 1917. Energy shortages soon afflicted the nation and gasoline rationing began in 1942, curtailing recreational boating on the Kentucky and stimulating a revival of coal barging on the upper river. John Marr of Lexington with the towboat *Nancy M.* began barging coal from Beattyville to Clays Ferry in July 1942. Learning that Marr could not load his barges to the full six-foot depth because the rusted A-Frame trestles had been removed from the crests of Dams Nos. 12 and 13, the Corps installed wooden flashboards atop the dams to restore the six foot channel. With this done, Marr managed to barge 900 tons of coal a week to Clays Ferry, from whence it was trucked overland to supply Lexington's energy needs.⁴³

Passing the *Muhlenberg*
through Lock No. 2 in winter.



With the end of the war in 1945, shipments of coal on the upper river ceased, and sharp cuts in its operations and maintenance budget forced the Corps to again consider the Kentucky project's future. Because no commercial traffic whatsoever passed through Locks Nos. 8 through 14 in 1946, Colonel B. C. Dunn proposed laying off the lock forces and renting out the lockhouses. He suggested creating a roving force of lock operators which would travel to the locks and operate them only when a commercial tow requested it.⁴⁴

Dunn's lock closure proposal was rejected, but in 1946 he closed the old Cincinnati District, laying off many of its 1200 employees. He transferred management responsibility for the Kentucky River to the Louisville Engineer District, which closed the Saylor Park repair station near Cincinnati and moved the Kentucky River repair fleet to Louisville.⁴⁵



Lockmaster John Walters and family at Lock No. 10 on July 25, 1910. They described themselves as the "whole dam family."

Although the future of the Kentucky's navigation project seemed bleak in 1946, the river had achieved national renown and renewed state interest during the war thanks to historian Thomas D. Clark of the University of Kentucky. In the famed *Rivers of America* book series, Clark published *The Kentucky* in 1942. After highlighting the Kentucky River's history, he declared it a bold, unique stream emblematic of the rugged Kentucky life style and he objected to comparing it to any other river. Certainly it should not be compared to the Rhine, which is four times as long, draining an international watershed twelve times larger, and carrying a commerce manifold greater than the Kentucky's. Still, similarities exist: the Rhine, for example, has water quality and flooding problems exceeding even those of the Kentucky.⁴⁶

Kentucky River

13

KENTUCKY RIVER TRANSITION

All the human affairs, all the human accomplishments and failures have been dreamed by this stream. What an artery it has been, a veritable pathway of civilization.

Thomas D. Clark, 1997

At mid-century the focus on Kentucky River water resources shifted from navigation to flood control and later to water quality and supply, recreation and environmental enhancement. As commerce on the river became sporadic after the Second World War, the Corps of Engineers made reducing the river's flood damages its highest priority. It built two dams for flood control on the river's forks, sought to build more, and cooperated with Frankfort's efforts to wall off the city from floods. It sought and failed to encourage recreational traffic on the river and cooperated with other federal and state agencies concerned with the river's water quality and supply. As commerce on the upper river died, the Corps closed Locks Nos. 5 through 14 and campaigned to transfer them to the Commonwealth. This transition proved to be as haltingly difficult as the nineteenth century campaign to build the locks and dams.

In an effort to concentrate constrained funding for operations and maintenance on rivers that carried substantial commerce, the Corps during the postwar years sought to reduce expenditures on its obsolete steamboat navigation projects. It suspended operation of its locks and dams on the Big Sandy and Little Kanawha rivers in 1952, as examples, and in 1958 returned the locks on the Muskingum River to the State of Ohio.



Operating valves in the lockgates was done by hand.



Lockmen turn the capstan to open the gates at Lock No. 8. In addition to turning the capstan in circles, they walked up and down the lockwalls to each capstan.



A 1958 view showing how electric drill motor coupled to a reduction gear made it possible for one lockman to operate lockgates.

On the Kentucky River, as early as 1951 the Corps proposed closing the navigation locks upstream of Frankfort. Intense political opposition and sporadic commercial coal shipments on the upper river thwarted these initial efforts to close the locks, but when coal shipments ceased in 1975 the Corps curtailed operations and closed the locks upstream of Frankfort in 1981. Fiery opposition to this closure came from recreation boaters and the half-million Kentuckians who drew on the river for water supply, and the Corps leased the locks to the Commonwealth for continued operation during recreation seasons. While this leasing arrangement continued into the 1990s, the Corps and the Commonwealth forged plans for transferring Locks Nos. 5 through 14 to state ownership while the Corps continued operation of Locks Nos. 1 through 4 built by the state in 1842. This arrangement seemed ironic: the Corps now operated the antique locks built by the Commonwealth before the Civil War on the lower river, while the Commonwealth operated the locks built by the Corps on the upper river during the Gilded Age.

* * * * *

"There is no commercial navigation on the Upper Kentucky at present and none is expected in the foreseeable future," said Colonel Clarence Bidgood of Louisville in 1951 when he announced the Corps would close Locks Nos. 8 through 14. From the end of the Second World War to 1951, no commerce plied the river upstream of Lock No. 7 and the sole remaining commerce consisted of sand and gravel barges coming upriver to Frankfort and occasional gasoline shipments up to Camp Nelson. Responding to budget restrictions by Congress and President Harry Truman, the Corps proposed closing its unused navigation locks on the upper Kentucky along with locks on the upper Green and other rivers. If the Commonwealth desired, Colonel Bidgood suggested the Corps would turn the locks over to the state to operate during summer recreational seasons.¹

Forthright protests greeted the Corps announcement. In Lexington, Caruthers Coleman and George Tomlinson formed the Kentucky River Development Association to fight the closing. Coleman declared the Corps' \$80,000 a year savings resulting from the lock closure "piddling" and claimed the Corps merely wanted to close the locks so it could build its proposed Jessamine Creek flood control dam on the Kentucky without further protest from river businesses and boatmen.²

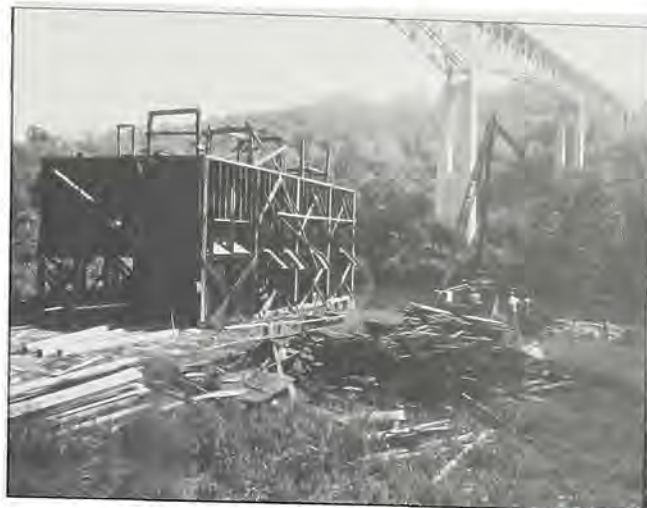
The influential Hazard Coal Operations Association also protested, calling on Congressmen John C. Watts and Carl Perkins and Senators Earle Clements and Thomas Underwood to thwart the Corps' plans. Further, the Association announced plans to begin shipping coal by rail to Bellepoint near Lock No. 14 for transshipment by river barge, predicting that one million tons of coal annually would soon descend the Kentucky to market. Privately, Corps officials sneered at this prediction, one saying: "If anybody could ever get a million tons of coal through one of those bathtub-sized locks on the Kentucky River they would really have to work at it 24 hours a day for 365 days a year, one barge at a time holding a net cargo of 300 tons."³

Kentucky Governor Lawrence Wetherby pronounced the Commonwealth strongly opposed to closing the locks, while the state's delegation in Congress considered the closure a "cutting away of the ties to the past" that threatened Bluegrass water supply. At the time, Lexington was building a second pipeline to tap the river for an additional eight million gallons daily. Although the House of Representatives omit-



U.S. Coast Guard
Auxiliary from
Louisville passing Lock
No. 8 in July 1950.

Tipple and derrick for unloading coal barges at Clays Ferry in 1952.



Towboat *Shamrock* and barges loading coal at Gilley's tipple near Beattyville in 1952.



ted funding for operating the Kentucky River locks from the 1952 budget, Kentucky's delegation restored the funding in the Senate. Debates concerning these maneuvers delayed passage of the federal budget, and as a result the Corps actually closed the Kentucky's upper locks briefly in August 1951 until the budget became law and made funding available.⁴

Coal operators hurriedly chartered boats and began shipping coal down the Kentucky in 1952 to supply steam-electric plants at Ford and Tyrone and domestic users at Lexington. Charles Gilley of Winchester built a barge-loading plant at Beattyville, an unloading dock at Clays Ferry, and chartered the towboat *Shamrock* to move the coal barges downriver. When his wooden barges and their loads of coal sank at Clays Ferry, Gilley purchased steel barges and claimed he could deliver barged coal to Lexington for only seventy cents a ton, compared to railroad charges of \$2.80 per ton. By the spring of 1953, the little *Shamrock* had completed seven trips to Clays Ferry, delivering a total of 6,800 tons of coal. This was equivalent to a single train load of coal and far short of the predicted million tons annually. "We could have bought coal and given it away at that rate," lamented Colonel Clarence Bidgood, "and saved the taxpayers money." He and the Corps therefore made future operation of the upper locks contingent on continuing commercial use of the river.⁵

A second coal-barging operation began in 1953 when coal-operator D. D. Stewart of Pineville chartered the towboat *Josie* to tow coal from Bellepoint near Lock 14 to the Ford and Tyrone steam-electric plants and also to whiskey distilleries. By moving about 5,000 tons monthly, Stewart's operation contributed to advancing river commercial statistics. The Kentucky's annual commercial tonnage gradually climbed from 66,000 tons in 1951 to 317,000 tons in 1958.⁶

With coal commerce developing, the Corps ceased complaining about commercial stagnation on the upper river, and Congressman Carl Perkins, representing the coal-producing mountain district, urged modernization of the Kentucky's navigation system. At a watermelon slicing sponsored by the Kentucky River Development Association, Perkins heard the Beattyville Chamber of Commerce's concerns about youth migrating from the mountains north to find jobs in Ohio and Indiana and its belief

that new and larger locks on the Kentucky River would attract industry and provide local employment. Finding this argument persuasive, Congressman Perkins added his influential support to modernizing and enlarging the river's locks. If it were done, he predicted hundreds of thousands of tons of Eastern Kentucky coal would go to market via the river.⁷

Congressman Perkins' advocacy of larger locks found little support, but he also became a foremost advocate of flood control in Eastern Kentucky. He and Kentucky's congressional delegation secured the construction of several flood control and protection projects in the Kentucky River basin. The first of these was at Jackson on the Kentucky's North Fork. Nestled in a valley below a long river bend around a mountain called the Panhandle or Panbowl, Jackson often suffered flood disasters. To reduce flood levels there, the Corps in 1956 excavated a new overflow channel through the neck of the Panhandle bend, shortening the river by four miles, to hurry floods past the town.⁸

Also in 1956 the Corps began the construction of Buckhorn Dam and Lake for flood control on the Kentucky's Middle Fork. After the Buckhorn Watershed Association, formed in 1953 by William Gorman and Vernon Cooper, organized local support and presented a petition to Congress signed by 12,000 voters urging the project's construction, Congressmen Carl Perkins and James Golden and Senator Earle Clements marshaled project funding through Congress in 1954. The Corps completed the 162-foot high Buckhorn Dam in 1960, impounding a lake on Middle Fork from Buckhorn up to Hyden. This project operated to reduce flooding levels along the Kentucky and also to provide recreation and water supply.⁹

After Congress in 1962 terminated Corps studies of the proposed Jessamine Creek flood control dam on the Kentucky near Camp Nelson, the Corps studied smaller flood control dams on tributaries and focused on protecting Frankfort by walling off the city from the river. After a severe flood in 1964, Frankfort's Mayor "Pete" Flynn pressed for construction of the North Frankfort floodwall levee in conjunction with major urban renewal. With Frankfort's cooperation, the Corps completed the levee around North Frankfort in 1971 and delivered it to the city for operation. Behind the levee, the city cleared the "Craw" area and completed an urban renewal project including new federal and state office buildings, a civic center, and hotels from the levee uphill to the Old Capitol Building.¹⁰

Located "two miles from Sassafras near the Little Dove Church," tiny Carr Fork Dam and Lake was the second and last flood control dam built by the Corps in the Kentucky River basin. Providing flood protection for Hazard, Kentucky, it was considered Congressman Carl Perkins' pet project. He and Governor Edward "Ned" Breathitt broke ground for the dam in 1966, and, after a funding freeze during President Richard Nixon's administration, it went into operation in 1975. Filling the lake forced the closing and relocation of little Carr Creek High School, which with only twenty-four students had placed second in the 1928 state basketball tournament and had won the 1956 state championship. Carr Fork Lake later was renamed Carr Creek Lake to perpetuate the famous school's name.¹¹

The most promising flood control dam site on a Kentucky River tributary also became the most controversial. Because it lay at the lower end of the arch-adorned Red River Gorge and Natural Bridge State Park, the Red River Dam excited vehement public opposition, marches on Frankfort, shoving matches at public hearings, and Supreme Court Justice William O. Douglas's accusation that the Corps of Engineers was "Public Enemy No. 1." This came after Douglas and protesters hiked through the stunning Gorge area in November 1967, booting the proposed dam into the national spotlight. Subsequently, at Governor Louie Nunn's request, the Corps moved the proposed dam site farther down the Red River and

out of the Gorge. Still, angry crowds shouted down Corps officers and Congressman Carl Perkins at hearings on the new site. When Governor Julian Carroll in 1975 withdrew state support for the Red River dam, the Corps tossed its project studies into the inactive bin.¹²

Only Buckhorn Lake and tiny Carr Fork Lake were operating in December 1978, therefore when a twelve-inch rain fell over central Kentucky on saturated ground and sent a seething flood down the Kentucky. It crested at 48.5 feet on December 10, a foot higher than the 1937 flood crest, engulfing all of low-lying Frankfort except the area protected by the North Frankfort floodwall and causing millions of dollars in flood damages. In the flood's aftermath, Congressman Carl Perkins lamented that the Red River dam might have prevented some of the damages, but would never be built until Lexington and Frankfort drank the Kentucky River dry during a drought. To which a project opponent retorted: "It was a boondoggle then and it's still a boondoggle."¹³

The 1978 flood also swept the upper Kentucky River nearly clean of docks and marinas serving recreational traffic, further aggravating the long-term decline in both recreational and commercial use of the locks. Coal shipments from Beattyville to the Ford and Tyrone steam-electric plants, which had averaged 109,800 tons annually, ceased in 1964; and the barging by Gulf Oil Company of 65,500 tons of gasoline yearly to Frankfort ended in 1969. The sole regularly scheduled commercial traffic left on the river was sand barged from Milton, Kentucky, on the Ohio River up to Frankfort by Dreyer, Whitehead, and Goedeke. Bringing up six barges weekly, this firm wholesaled the sand for highway and structural construction throughout the Bluegrass.¹⁴

As commercial traffic diminished, the Corps made an abortive attempt to encourage recreational boating. After inspecting the river in 1964, Colonel Willard Roper reported the river's environmental beauty strongly impressed him of its potential recreational uses. To encourage river recreation, Frankfort and state government in 1964 inaugurated annual Kentucky River Admiral boat parades attracting dozens of boats and thousands of spectators each summer. This development intrigued Colonel Roper, and he commented: "Since commercial traffic above Frankfort has almost disappeared, with no apparent prospect of future increase, the recreational development potential seems to offer possible means for restoring maintenance and operation of the project to a more feasible economic status."¹⁵

Roper's successor in command of the Louisville District, Colonel Robert Wessels, met with Kentucky Governor Edward "Ned" Breathitt and state officials in 1967 and 1968 to explore opportunities for encouraging the Kentucky's recreational boating. When Congress authorized the Corps to study creation of National Recreation Areas along rivers, the Louisville District urged the formation of a Kentucky River National Recreation Area. This would have included portions of the Daniel Boone National Forest, state parks at Boonesborough and Natural Bridge, and the river's spectacular Palisades; this plan would have preserved natural environments by purchasing scenic easements and paying landowners for the right to prohibit commercial development, road construction, and logging along the Palisades and nearby recreational attractions. Colonel Wessels hoped a National Recreation Area designation for the Kentucky River might include congressional recognition of its service to recreation as a purpose of the river's locks and dams, thereby justifying the expense of rehabilitating the aging structures. This initiative failed when the National Recreation Area designation went instead to the Big South Fork of the Cumberland River. Recreation boating on the Kentucky peaked at 12,400 lockages in 1970, then declined to 6,400 lockages in 1978, most likely a result of the Corps' completion of large flood control lakes more accessible to boaters from the Louisville, Cincinnati, and Lexington urban areas than the Kentucky River.¹⁶

Coal barging on the upper Kentucky River briefly revived during the 1973 oil embargo and energy crisis. William Hughes and Commonwealth Towing of Lexington in 1974 began barging coal from Bellepoint near Lock No. 14 downriver. This effort soon ended in 1975, however, after only 25,000 tons of coal had passed the locks, and it proved to be the last commercial towing on the upper river except an occasional barge load of bridge trusses or industrial equipment.¹⁷

Litigation during the 1970s disrupted Corps operations on the Kentucky River. Lockmasters on the river, required to live in the lockhouses as a condition of employment, claimed they had to work their normal shifts and then provide standby services without pay at other times. After twice denying these claims, the U.S. Comptroller General accepted them in 1976 and awarded the lockmasters a total of \$2.5 million in back pay. The Corps immediately took steps to reduce this liability in the future: it made residing in the lockhouses optional and curtailed the hours of lock operation on the upper Kentucky. This service reduction probably also contributed to the decline of recreational boating on the river.¹⁸

Receiving orders to reduce its number of employees, the Louisville District in 1977 again considered closing the locks upstream of Frankfort. By dividing its operations and maintenance budget for the Kentucky River by the number of boats passing the locks, the District estimated it cost an average of \$160 for each boat passing through Locks Nos. 1 through 4 on the lower river. The average cost for passing each boat through Locks Nos. 5 to 14 was \$566, and these were recreation craft only. After efforts to interest state government in operating the upper locks met rejection, the Corps in 1979 proposed to cease operating the locks to save about \$1 million annually and perhaps to give the structures to the communities drawing water supply from the navigation pools. The Corps' recommendation warned: "Failure of a Kentucky River structure could severely affect the water supply of Central Kentucky, which is already projected to be inadequate to meet future needs during drought years."¹⁹



The Kentucky lock force met in April 1975.

Standing from left:

John R. Bleidt (chief of operations), Roy Parrish (No. 5), John Sparks (No. 4), John Lambert (No. 11), Richard Finney (No. 6), Ralph Conway (No. 8), Charles Dees (No. 7), Earl Gulley (No. 12), Jessie Dalton (No. 10), John Lawson (No. 14),

Seated from left:

Randall Lytle (Green River No. 3), Roy Berry (No. 12), Charles Ballman (No. 9), Estill Thomas (No. 2), Thomas Buck (No. 3), and Russell Dees (No. 1).

Kentuckians loudly objected to the closure proposal. More than 400 attended a Corps meeting at Lexington in 1980 to discuss and unanimously oppose it. The speakers warned of the loss of recreational opportunities and the economic setback to businesses serving the recreational traffic. During the "Reagan Revolution" of 1981, however, when President Ronald Reagan stringently pared the 1982 federal budget, funding for the Kentucky River was omitted. The Corps announced it would cease operating Locks Nos. 5 through 14 on October 1, 1981, not reopening them during the 1982 recreation season, and perhaps never again.²⁰

The Commonwealth quickly established a Kentucky River Task Force to study the issues while state and county executives protested the closure to Washington. In response to these protests and lobbying by Larry Hopkins and other Kentucky congressmen, the Assistant Secretary of the Army reassessed the closure and provided funding for limited lock operations during the 1982 recreation season. He also requested the state and county executives protesting the closure to advance a plan for future lock operations by state or local governments.²¹

In September 1982 the Corps again closed the upper locks and the Commonwealth's task force completed its interim study. The task force urged the Corps to continue its operation of Locks Nos. 1 through 4 and to undertake repairs at Locks and Dams Nos. 5 through 14 to ensure against their failure during negotiations with the state. It recommended also that state government consider leasing the upper locks for summer recreation operation. The upper locks remained closed during the protracted negotiations until 1984 when the Kentucky legislature provided initial funding to operate the locks under a leasing arrangement. In November 1984 at Frankfort, Congressman Larry Hopkins and Assistant Secretary of the Army Robert Dawson met with Governor Martha Layne Collins. After receiving the Governor's word that the Commonwealth would consider taking ownership of the upper locks, Dawson released the funds needed to repair the locks for resumed operations.²²



Governor Martha Layne Collins and Colonel Dwayne Lee, commanding the Louisville District, met on May 21, 1985, at Lock No. 5 to inaugurate state operation of locks upstream of Lock No. 4.

At Lock No. 5 on May 21, 1985, Governor Collins hoisted Kentucky's flag over the project, declaring this marked a "rejuvenation in the river's role in the commercial life of Central Kentucky." Under the lease agreement, the state funded recreation season operations and routine maintenance while the Corps continued to provide major maintenance until the state accepted ownership of the locks and dams. Managed initially by the Kentucky Water Patrol, the Kentucky River attracted increased recreational traffic during the 1980s. In 1979, the Corps had locked only 3,290 boats; in 1985 the total grew to 3,976 and in 1986 it climbed to 5,085. When Congress in 1986 authorized the disposal of the Kentucky River locks, the Commonwealth created the Kentucky River Authority to manage lock operations, also giving it bonding, regulatory, and eminent domain powers.²³

State takes control of 10 locks and dams on Kentucky River

Associated Press

LAWRENCEBURG, Ky. --- The state took control of 10 Kentucky River locks and dams from the Army corps of Engineers yesterday.

Gove. Martha Layne Collins, in the ceremonial reopening of Lock No. 5 near Lawrenceburg, signed a lease under which the state will operate the upper river's navigation system during a three-year transition from federal to state ownership.

The locks will open to boaters Friday, enabling the state's Natural Resources and Environmental Protection Cabinet to keep a promise to have at least part of the river reopened by the Memorial Day weekend.

Yesterday's ceremony was a step "toward realizing the potential of Kentucky River for recreation and tourism, for water resources and for commerce," Collins said.

She said she hopes it will mark "a rejuvenation in the river's role in the commercial life of Central Kentucky."

The ceremony was the culmination of long and sometimes bitter negotiations between the state and the corps for Kentucky's

eventual takeover of Locks 5-14, stretching from Lawrenceburg to Lee County.

The corps began welding shut the locks three years ago, saying the small volume of commercial traffic on the river didn't justify the cost of its navigation system.

Once closed, the locks fell into disrepair. The 1984 General Assembly authorized the Natural Resources Cabinet to negotiate the system's acquisition and appropriated \$325,000 for its operation and routine maintenance for two years.

Legislators refused, however, to earmark any money for repairs needed to reopen the locks, saying the work wouldn't have been needed if the corps hadn't closed them. Federal officials later agreed to spend \$500,000 for repairs.

Under the three-year operating agreement, the state and the corps are to share major maintenance expenses. However, the corps alone can decide what constitutes major maintenance, prompting some legislators to say the state could be saddled with heavy expenses under the guise of routine maintenance.

The agreement gives either side the right to cancel.

This article appeared in the *Courier Journal* on May 22, 1985.



The Dixie Belle carried excursions near Lock No. 7, Shakertown, and High Bridge during the 1980s and 1990s.

The extended drought of 1988 highlighted the worth of the Kentucky River dams for water supply. Aptly described as “beautiful weather extending to the brink of disaster,” early 1988 saw little rainfall in the Kentucky River basin and indeed in the entire Midwest. The resulting low flows on the Kentucky threatened water supplies, and on July 8 the Governor declared a state of emergency in anticipation of major disaster. Kentucky closed Locks 5 through 14 to hold water for the communities dependent on the navigation pools for their supply. During this emergency the Corps released water from Buckhorn Lake to augment the Kentucky’s flow, and releases from its other reservoirs supplied about half the flow of the Ohio River past Louisville before rains ended the emergency in September 1988.²⁴

When the drought ended, Lexington’s Mayor Scotty Baesler formed a Kentucky River Basin Steering Committee with state, local, and private funding to study regional water supply improvement. While studying the construction of additional reservoirs, more high dams on the Kentucky, and building a pipeline to the Ohio River, this committee recommended strengthening the existing locks and dams on the Kentucky River as a short-term water supply enhancement. It also urged the Commonwealth to expand the responsibilities of the Kentucky River Authority to include water resources management in addition to operating the locks and dams for recreation. Governor Wallace Wilkinson in 1988 signed legislation in which the Commonwealth agreed to eventually accept ownership of the locks and dams, and in 1990 the Commonwealth gave the Kentucky River Authority broader powers to manage the valley’s water resources with funding derived from the assessment of surcharge fees on communities using the river for water supply.²⁵

Acrimonious disputes and litigation between the Corps and the Commonwealth over disposition of the Kentucky River project waned when they jointly agreed to an orderly transition. The state agreed to accept project ownership providing the Corps completed repairs and improvements to make the Kentucky River dams dependable for water supply. Senator Wendell Ford, Congressman William Natcher, and Kentucky’s congressional delegation in 1992 obtained a \$5 million appropriation to start the Corps’ strengthening of the dams. With this and subsequent appropriations, the Corps contracted for the repairs at the dams. The typical repairs involved stopping leakage through the dams, building cut-off walls on the upstream sides of the dams, and rehabilitating the downstream spillway aprons. By 1998 this work approached completion.²⁶

The Kentucky River Authority included the Commonwealth's Secretary of Natural Resources and ten representatives from the river valley; among these were a mayor, a county judge, an engineer, a water quality expert, and representatives of counties bordering the river. Thomas Dorman became the Authority's chairman and served through the 1990s, implementing a broad agenda for managing Kentucky River resources.²⁷

Funded by surcharges on water withdrawals from the river, the Authority initiated an array of programs. It sponsored the Kentucky River Sweep, a volunteer campaign to clean litter from the riverbanks. Working jointly with the Corps, the Authority continued operation of the locks during summer recreation seasons and planned the transition to state ownership of Locks and Dams Nos. 5 through 14. It assessed the public use potential of each lock site and planned future developments, and to enhance water supply it proposed installing water-release valves in the dams and placing movable crests or flashboards on some dams to hold additional water during droughts.²⁸

Water quality became a major concern when the popular Boonesborough beach closed to swimming during the 1988 drought. This had been predicted in 1970 by reporter John Fetterman who was alarmed by pollution of the river. After examining its condition, Fetterman found the Kentucky itself cleaner than many other rivers but saw an "unholy mess" in its headwaters along the Three Forks, predicting the Bluegrass region would eventually pay for neglecting the upstream conditions. During the 1980s, the U. S. Geological Survey observed dramatic increases in the amount of salt in the river and speculated that the source might be flow from the thousands of abandoned salt wells drilled at the nineteenth century saltworks, or perhaps a result of pressurized pumping at oil wells. During the 1988 drought and subsequent summers, however, the concern was contamination by bacteria from human and animal wastes, threatening swimmers with eye and ear infections. At Fort Boonesborough State Park, the Commonwealth funded the construction of a community pool to serve in lieu of the beach for public swimming.²⁹

Kentucky River Authority Chairman Thomas Dorman at Frankfort observed that fees collected from water users along the Three Forks might be returned to them as matching grants to modernize their sewage treatment systems. "If we can clean the water up there," Dorman asserted, "it will be better water flowing down to us."³⁰

Artifacts, such as this bonnet valve, were recovered during the repairs made to Kentucky River structures during the 1990s.



During the project repairs of the 1990s, new concrete walls were installed above the old dams to further secure them against leakage and loss of water supply.

"Daniel Boone would spin in his grave," lamented Congressman Hal Rogers, "if he knew that Boonesboro Beach was closed to fishing and swimming by human beings a good part of the year because of sewage in the river." In 1996, Rogers obtained authorization for Corps participation in the design and construction of modern sewage treatment and water supply plants in Eastern Kentucky including the Kentucky River's headwaters. Rogers admitted that improving the river's water quality would be neither cheap nor easy, but he thought it essential to the Commonwealth.³¹

Although it funded restoring the Kentucky River dams for water supply, Congress provided no funding for major repairs to the locks, and as the lockgates deteriorated the Kentucky River Authority had difficulty keeping them open during summer recreation seasons. Dividing the total operations and maintenance costs by the number of boats using the locks, Dorman estimated the state spent about \$250 for each boat passing the locks; this was not cost effective, and assessing boaters such large fees would drive them from the river. The Corps and the Commonwealth continued the transition to state ownership, however, gradually forging agreements for the transfer of each lock individually rather than as a whole project. In 1996 the quitclaim deed for Lock and Dam No. 10, jointly prepared by the Corps and Commonwealth, transferred the title to this lock to the state; it would serve as the prototype for similar deed transfers at the other locks.³²

The Corps spent thirty-seven years from 1880 to 1917 building Locks and Dams Nos. 6 through 14. It appears that transferring ownership of these to the Commonwealth may well require a similar span of years; indeed, the span is longer if one considers the Corps effort in 1951 to close the locks as its beginning. It required eighty years to build the Kentucky River navigation, from 1836 when the Commonwealth's Board of Internal Improvement began building the locks and dams, until 1917 when the Corps completed the slackwater navigation to the Three Forks. By 1997, the Corps and the Commonwealth had operated the entire lock and dam system for eighty years.

For 160 years, the Kentucky River navigation project has been integral to the Commonwealth's history and to the history of the Corps of Engineers. The lower five locks are monuments to the dreams of Kentucky's Whig party, the upper nine locks are relicts of the post-Civil War Bourbon Democracy, and all mark the baptism of the Corps of Engineers in the turbulent Kentucky River. As well they should, Kentuckians are concerned about this historic project's future, and the Commonwealth has made its Kentucky River Authority the project's steward. By 1998 some of the Authority's noteworthy plans for the project's future had become apparent.

With capital bond issues authorized by the legislature, the Kentucky River Authority worked with the Nature Conservancy to acquire land along the magnificent Palisades to preserve the rugged and unique environment and also to enhance "ecotourism." At Lock No. 10 adjacent to Fort Boonesborough State Park, the Authority funded the Kentucky River Museum, planning to restore the lockhouses that served through the twentieth century as the homes of the lockmasters and their families. These buildings would house artifacts and exhibits relating to the locks and river folklife for historical and public educational purposes. Other lockhouses and reservations along the river may also become community centers and parks.³³



Those present for the opening ceremony of the Kentucky River View Park on September 19, 1997 were (left to right): Thomas M. Dorman, James C. Codell, Dr. Thomas D. Clark, William I. May, Jr., Charles Bush, Teresa Barton, Houston Wells.

At the downstream end of the Palisades at Frankfort, the Kentucky River Authority joined with other state and local agencies to develop Kentucky River View Park, a linear park along the state capital's riverfront where flatboats once embarked for New Orleans and steamboat packets whistled for landing. This park straddled the North Frankfort floodwall, easing public access to the river and its aquatic pleasures.³⁴

At the Kentucky River View Park's dedication in September 1997, historian emeritus Thomas D. Clark reminisced about his adventures on and studies of the Kentucky River throughout the twentieth century. Watching the sun sparkle from the river's waves, Clark urged the creation of a national or state park stretching from the capital upriver past the Palisades at least as far as Fort Boonesborough. He challenged the state and local executives at the ceremony to see to its creation. "All the human affairs, all the human accomplishments and failures have been dreamed by this stream," he declared, concluding: "What an artery it has been, a veritable pathway of civilization!"³⁵

Travelers zipping along interstate highways across the Commonwealth may cross two or more high bridges spanning a spectacular river gorge. If they look down, they see an astounding abyss and a winding ribbon of river sparkling beneath them. Most don't look down. They pass without notice the Commonwealth's artery of civilization. But historians and informed Kentuckians pause for long, thoughtful looks, as they likely will do so long as civilization endures.

Kentucky River

NOTES

1. THE PIONEER NAVIGATION

1. John Filson is quoted from his history, *The Discovery, Settlement and Present State of Kentucke* (Wilmington, Del., 1784); "Rev. James Smith's Journal," *Kentucky History and Genealogy* 1 (June 1899):53-64.
2. Ibid.
3. Chuck M. Niquette and A. Gwynn Henderson, *Background to the Historic and Prehistoric Resources of Eastern Kentucky* (Alexandria, VA: Bureau of Land Management, 1984), pp. 1-67; Donald B. Ball and Jan Marie Hemberger, "Results of an Archaeological Reconnaissance of Locks and Dams Nos. 1-14 on the Kentucky River, Kentucky," (draft report; Louisville: US Army Engineer District, 1987), pp. 1-9; Lucien Beckner, "John Findley: The First Pathfinder of Kentucky," *Filson Club History Quarterly* 1 (Apr. 1927):111-22; Lucien Beckner, "Eskippakithiki: The Last Indian Town in Kentucky," *Filson Club History Quarterly* 6 (Oct. 1932):355-812.
4. Niquette and Henderson, *Background to the Historic and Prehistoric Resources of Eastern Kentucky*, pp. 1-67; James H. O'Donnell, "Shawnee Indians," in John E. Kleber, ed., *The Kentucky Encyclopedia* (Lexington: University Press of Kentucky, 1992), pp. 814-15.
5. J. Stoddard Johnston, *First Explorations of Kentucky* (Louisville: John P. Morton and Co., 1898), p. 52.
6. Ibid., pp. 52-63.
7. Henry Timberlake, *Memoirs, 1756-1765* (Ed. by Samuel C. Williams; Johnson City, TN: Watauga Press, 1927), pp. 36-58, 84-85; Leland Baldwin, *The Keelboat Age on Western Waters* (Pittsburgh: University of Pittsburgh Press, 1941), p. 41.
8. Nicholas Cresswell, *The Journal of Nicholas Cresswell, 1774-1777* (New York: Dial Press, 1928), pp. 68-86; James Nourse, "Journey in Kentucky in 1775," *Journal of American History* 19 (Second Quarter, 1925): 121-38, 250-60, 351-644.
9. Cresswell, *Journal of Nicholas Cresswell*, pp. 68-86.
10. Ibid.
11. Ibid.; John Bakeless, *Daniel Boone* (reprint; Harrisburg, PA: Stackpole Co., 1965), pp. 124-25.
12. John Filson, *The Discovery, Settlement and Present State of Kentucke* (reprint; New York: Corinth Books, 1962), pp. 15-16.
13. "The Kentucky River and Its Islands," *Register of Kentucky Historical Society* 1 (1903):40-41. Lock and Dam No. 3 built in 1841 at Cedar Ripple became known as "Cedar Lock." Names of other ripples still listed on the US Army Corps of Engineers navigation charts are Pot Ripple (Mile 32.8), Sand Ripple (Mile 45), and Macy Ripple (Mile 63).
14. Cresswell, *Journal of Nicholas Cresswell*, p. 77, reported: "'found several rapids which obliged us to get out and haul our vessel up with ropes.'"
15. John G. Stuart, "A Journal of Remarks or Observations in a Voyage down the Kentucky, Ohio, Mississippi Rivers &c," *Register of Kentucky Historical Society* 50 (Jan. 1952):14.
16. Mary Verhoeff, *The Kentucky River Navigation* (Louisville: John P. Morton Co., 1917), pp. 49-52; Newton D. Mereness, *Travels in the American Colonies* (New York: Antiquarian Press, 1961), p. 635; *Richmond Globe*, Aug. 2, 1810. Jacks Creek and Valley View are short distances upstream of Lock and Dam No. 9.

17. Dwight L. Smith, ed., "The Ohio River in 1801: Letters of Jonathan Williams, Junior," *Filson Club History Quarterly* 27(July 1953):199-22; Dale Van Every, *The Ark of Empire: The American Frontier, 1784-1803* (New York: William Morrow and Co., 1963), describes the flatboats' role in pioneer settlement and commerce.

18. Van Every, *The Ark of Empire*, traces pioneer flatboat migrations. The passage of flatboats down the Kentucky, called moving or household boats, is often noted in Board of Internal Improvement Papers, Accounts of the Auditors Office, Kentucky State Library and Archives, Frankfort, KY, which lists the boats passing Locks Nos. 1-5 from 1843 to 1868. Journals of flatboat trips down the Kentucky are "Original Journal of John Halley of His Trips to New Orleans Performed in the Years 1789 and 1791," Special Collections and Archives, Margaret I. King Library, University of Kentucky, Lexington, KY; and John G. Stuart, "A Journal of Remarks or Observations in a Voyage down the Kentucky, Ohio, Mississippi Rivers &c," *Register of Kentucky Historical Society* 50(Jan.1952):5-25.

19. Verhoeff, *Kentucky River Navigation*, pp. 54-67; Lowell H. Harrison, "James Wilkinson: A Leader for Kentucky?" *Filson Club History Quarterly* 66 (July 1992):334-68. Hickman Creek is at Mile 136 near Camp Nelson; Dix River is at Mile 118 near High Bridge; and Scotts Landing, or Petersburg, is at Mile 89, the mouth of Craigs Creek.

20. Stuart Seely Sprague, "Kentucky and the Navigation of the Mississippi: The Climatic Years, 1793-1795," *Register of Kentucky Historical Society* 71(Oct. 1973):364-92; Verhoeff, *Kentucky River Navigation*, pp. 67-78; James Mak and Gary M. Walton, "The Persistence of Old Technologies: The Case of Flatboats," *Journal of Economic History* 33(June 1973):444-51; Jane Ross, "Flatters and Keelers of the Western Rivers," *Early American Life* 8(Feb. 1977):21-25, 60; Cargo Manifests, New Orleans Barges and Flats, Port of Natchez, Record Group 36, National Archives, Washington, DC, contains manifests for the *Winchester* and many Kentucky flatboats.

21. Leland Baldwin, *The Keelboat Age on Western Waters* (Pittsburgh: University of Pittsburgh Press, 1941), p. 41; W. Wallace Carson, "Transportation and Traffic on the Ohio and the Mississippi before the Steamboat," *Mississippi Valley Historical Review* 7(June 1920):32-35.

22. Cincinnati, OH, *Centinel of the North-West Territory*, Jan. 15, 1795; Cargo Manifests, New Orleans Barges and Flats, Port of Natchez, Record Group 36, National Archives, Washington, DC, contains the *Sophia's* and cargo manifests for other keelboats. Kentucky's tradition states Elijah Craig, a Baptist minister, also operated the first whiskey distillery in the state.

23. *Frankfort Palladium*, Mar. 3, 1803; *Lexington Kentucky Gazette*, Mar. 1, 1803, May 1 and 17, 1804; US Navy Historical Files, Record Group 45, National Archives, Washington, DC. While sailing from Santo Domingo to Curacao, the *Go By* was seized by the British ship *Diana* commanded by Pelican John Marshall and taken to Jamaica for condemnation.

24. *Ship Registers of the Port of New Orleans* (3 volume typescript; Washington, DC; National Archives II), I, pp. 22 and 71; *Kentucky Gazette*, June 4, 1804, May 21 and 28, 1805. The *Ceres* left Frankfort in May 1804, grounded on Fishtrap Island, then sailed to New Orleans, arriving on Aug. 10, 1804; it was 67 ft. and 2 in. long, 20 ft. and 4 in. wide, 7 ft. 8 in. hold, and had one deck, two masts, square stern, and round tuck. The *Jane* was 67 ft. 2 in. long, 19 ft. 8 in. wide, 7 ft. 6 in. hold, and had one deck, two masts, square stern, and round tuck. The cradle where the *General Scott* was built remained visible at Scotts Landing until the twentieth century. See also Richard T. Wiley, "Ship and Brig Building on the Ohio and Its Tributaries," *Ohio Archaeological and Historical Publications* 22(1913):54-64.

25. L. F. Johnson, *History of Franklin County, Ky.* (Frankfort: Roberts Printing Co., 1912), p. 35; Verhoeff, *Kentucky River Navigation*, pp. 222-23; *Frankfort Palladium*, Nov. 28, 1799; *Frankfort Commonwealth*, Nov. 22 and 29, 1834.

26. *Frankfort Palladium*, Nov. 28, 1799; Verhoeff, *Kentucky River Navigation*, pp. 222-23.

27. *Frankfort Palladium*, Nov. 28, 1799; Verhoeff, *Kentucky River Navigation*, pp. 222-23.

28. *Frankfort Commonwealth*, Nov. 22, 1834; Verhoeff, *Kentucky River Navigation*, pp. 19-21; William Littell, *The Statute Law of Kentucky* (5 vols. Frankfort: William Hunter, 1809-1819), II, 448-55, Act of Dec.19, 1801.

29. *Kentucky Gazette*, Dec. 11, 1804. When DuFour's vineyard venture on the Kentucky failed, he took his colony to found Vevay, Indiana, on the Ohio River.
30. *Frankfort Commonwealth*, Nov. 22, 1834.
31. P. N. Moore, "Report on the Iron Ores and the Iron Manufacture of the Kentucky Red River Iron Region," *Geological Survey of Kentucky* 4(1877):15-34; *Frankfort Commonwealth*, June 27, 1838, and Sept. 15, 1840; Littell, *Statute Law of Kentucky*, III, 249, Act of Dec. 5, 1805; see also Kentucky Acts of Feb 4, 1817, Mar. 8, 1854, and Mar. 21, 1870. Miller Creek is near Lock No. 12; the last iron boat from Miller Creek went downriver in 1886, when a spur railroad opened to the ironworks.
32. John F. Smith, "Salt-Making Industry of Clay County, Kentucky," *Filson Club History Quarterly* 1(Apr. 1927):131-41; Roy R. White, "The Salt Industry of Clay County, Kentucky," *Register of Kentucky Historical Society* 50(July 1952):236-48; Littell, *Statute Law of Kentucky*, IV, 94-95, Act of Jan. 8, 1810.
33. Kelly Morgan, *History of Clay County, Kentucky, 1767-1976* (Manchester, KY: Morgan Book Co., 1976), pp. 137-39; Littell, *Statute Law of Kentucky*, see Acts of Jan. 10, 1815, and Kentucky Acts of Jan. 29, 1836, Feb. 8, 1837, Feb. 16, 1838, Dec. 19, 1839, Feb. 21, 1840, Feb 28, 1848, and Feb. 25, 1876.
34. J. Winston Coleman, "Kentucky River Steamboats," *Register of Kentucky Historical Society* 63(Oct. 1965):299-300; Verhoeff, *Kentucky River Navigation*, p. 96; *Kentucky Gazette*, Apr. 22, 1816, Mar. 27 and Sept. 11, 1818.
35. Richard G. Wood, *Stephen Harriman Long, 1784-1864* (Glendale, CA: Arthur H. Clark Co., 1966), pp. 59-94; Leland W. Meyer, *The Life and Times of Colonel Richard M. Johnson of Kentucky* (New York: Columbia University Press, 1932), p. 193; *Kentucky Gazette*, Oct. 23 and 30, 1818, and Mar. 19, 1819. The Johnsons acquired the steamboats for the Army's Yellowstone Expedition up the Missouri River, and Captain Stephen H. Long and the Corps of Engineers built the steamboat *Western Engineer* at Pittsburgh to accompany this expedition.
36. See sources cited in note 35 above and Samuel M. Wilson, "Leestown—Its Founders and Its History," *Register of Kentucky Historical Society* 29(Oct. 1931):395.
37. *Ibid.*; *Ship Registers of the Port of New Orleans*, II, 130.
38. *Kentucky Gazette*, July 31, 1818. The 198-ton *George Madison* was built at Pittsburgh in 1817 and named for a Frankfort resident who was Kentucky's Governor in 1816. Its captains were John Holton of Frankfort and William T. Pemberton.
39. Gov. Gabriel Slaughter's message to the legislature of Dec. 2, 1817, is printed in *Niles' Weekly Register* 13(Feb. 7, 1818):388.
40. *Frankfort Commonwealth*, Nov. 22, 1834; *Kentucky House Journal, 1818-1819*, pp. 313-14, prints the 1818 commercial statistics, and pp. 30-32, 130-32, 297-98, prints reports by Commissioner Richard Taylor for the river section below Frankfort, by John Yantis for the Frankfort to Jacks Creek section, and by Daniel Garrard for the upper river and its South Fork to his saltworks.

2. INTERNAL IMPROVEMENTS

1. *Kentucky House Journal, 1830-31*, p. 15, quotes Kentucky Governor Thomas Metcalfe; Clement Eaton, *Henry Clay and the Art of American Politics* (Boston: Little, Brown and Co., 1957), pp. 34-47; George R. Poage, *Henry Clay and the Whig Party* (Chapel Hill: University of North Carolina Press, 1936), pp. 11-13; E. Malcolm Carroll, *Origins of the Whig Party* (New York: Da Capo Press, 1970), pp. 24-25.
2. Secretary of War John C. Calhoun, "Roads and Canals," Jan. 14, 1819, *American State Papers, Class X: Miscellaneous*, II, pp. 533-37 (quote on p. 534); see also George R. Taylor, *The Transportation Revolution, 1815-1860* (Vol. IV, *Economic History of the United States*; New York: Rinehart and Co., 1951).

3. Leland R. Johnson, *The Falls City Engineers: A History of the Louisville District, Corps of Engineers, United States Army* (Louisville: US Army Engineer District, 1975), pp. 38-46; Curtis Nettels, "The Mississippi Valley and the Constitution, 1815-1829," *Mississippi Valley Historical Review* 11(Dec. 1924):332-38; Henry Clay, "Speech on Internal Improvements," Jan. 14, 1824, in James F. Hopkins and Mary M. Hargreaves, eds., *The Papers of Henry Clay*, Vol. III: *Presidential Candidate, 1821-1824* (Lexington: University Press of Kentucky, 1963), pp. 572-93; Victor L. Albjerg, "Internal Improvements without a Policy," *Indiana Magazine of History* 28(June 1932):168-79; Richard G. Wood, *Stephen H. Long, 1784-1864* (Glendale, CA: Arthur H. Clark Co., 1966), pp. 147-49.
4. Johnson, *Falls City Engineers*, pp. 39-44; Henry Clay, "Speech on Internal Improvements," Jan. 14, 1824, in Hopkins and Hargreaves, eds., *Papers of Henry Clay*, III, pp. 572-93; Leland R. Johnson, "The Contest and Contract of 1824," *Military Engineer* 65(May-July 1973): 166-71, 252-57.
5. Wood, *Stephen H. Long*, pp. 143-53; Forest G. Hill, *Roads, Rails & Waterways* (Norman, OK: University of Oklahoma Press, 1957), reviews Corps activities under the General Survey Act of 1824.
6. U.S. Senate, *Reports and Draughts of Surveys for the Improvement of Harbors and Rivers and the Construction of Roads and Canals* (Washington, DC: Gales and Seaton, 1839), prints early reports on canal projects; Leland R. Johnson, "Muscle Shoals Canal, Tennessee River," *Military Engineer* 63(July 1971):260-65; Taylor, *The Transportation Revolution, 1815-1860*, reviews the "canal craze."
7. Paul B. Trescott, "The Louisville and Portland Canal Company, 1825-1874," *Mississippi Valley Historical Review* 44(Mar.1958):686-708; Heber P. Walker, "Louisville and Portland Canal," *Indiana Magazine of History* 28(Mar. 1932):21-30.
8. *Kentucky House Journal, 1835-1836*, Appendix, pp. 87-88, is Maj. R. Philip Baker's survey of a canal from Kentucky River to Cumberland River.
9. Lewis Collins and Richard H. Collins, *History of Kentucky* (Reprint: Berea, KY: Kentucke Imprints, 1976), I, 537-51. To compare with Kentucky's projects, see Stanley J. Folmsbee, *Sectionalism and Internal Improvements in Tennessee, 1796-1845* (Philadelphia: University of Pennsylvania Press, 1939).
10. *Kentucky Senate Journal, 1824*, pp. 9-10.
11. *Kentucky Senate Journal, 1827*, pp. 14-15; Trescott, "Louisville and Portland Canal Company," pp. 686-708.
12. *Kentucky Senate Journal, 1824*, pp. 376-82
13. Ibid. Committee members were Thomas C. Howard, Samuel MacCoun, Granville Bowman, James Allen, and Chittenden Lyon.
14. Ibid.
15. *Kentucky Senate Journal, 1826*, pp. 105-12.
16. Ibid. See also Nettels, "Mississippi Valley and the Constitution," pp. 332-38.
17. *Kentucky House Journal, 1826*, pp. 104-09; Robert V. Remini, *Andrew Jackson and the Course of American Democracy, 1833-1845* (New York: Harper & Row, 1984), p. 318, notes Pres. Jackson supported distributing federal surpluses to states for public works and education.
18. Collins, *History of Kentucky*, I, 538; Wood, *Stephen H. Long*, pp. 148-49.
19. Lowell H. Harrison, "Thomas Metcalfe," in Kleber, ed., *Kentucky Encyclopedia*, pp. 629-30; Leonard Curry, "Election Year—Kentucky, 1828," *Register of Kentucky Historical Society* 55(July 1957):196-213. Kentuckians take pride in stone structures built by Metcalfe such as the Green County courthouse built in 1803; see R. L. Durham, "Greensburg, the Capital of Green County, Has Rich History," *Kentucky Explorer* 12 (May 1997):23-25.
20. *Kentucky House Journal, 1828-1829*, pp. 18-19.

21. *Kentucky House Journal*, 1828-1829, pp. 141-46.
22. *Ibid.*
23. Charles J. Bussey, "James Guthrie," in Kleber, ed., *Kentucky Encyclopedia*, p. 396; Frankfort *Commonwealth*, Mar. 20, Apr. 2, 23, 30, June 25, 1844. James R. Skiles, promoter of the Green River navigation, also became a Democrat.
24. Collins, *History of Kentucky*, I, 538; John Klee, "Maysville Road Bill," in Kleber, ed., *Kentucky Encyclopedia*, p. 622.
25. Collins, *History of Kentucky*, I, 537-51; J. S. Watkins, "A Look at the Early Days of Kentucky's Highways and Roadbuilding," *Kentucky Explorer* 11(Apr. 1997):8-11; *Kentucky House Journal*, 1835, p. 22; Frankfort *Commonwealth*, Dec. 21, 1847, prints obituary of Judge Richard A. Buckner.
26. *Kentucky Acts*, 1827-1828, pp. 132-34; Richard A. Buckner to Topographical Bureau, Mar. 16, 1827, Registers of Letters Received, 1825-1865 (Microfilm 505), Records of the Office of the Chief of Engineers, Record Group 77, National Archives (this Record Group cited hereafter as NARG77); Kentucky Board of Internal Improvements to Topographical Bureau, Mar. 7, 1828, *ibid.*; Thomas Chilton to Topographical Bureau, Mar. 22, 1828, *ibid.*; Lt. William Turnbull to Topographical Bureau, July 31, Sept. 2, Nov. 4, 1828, *ibid.*
27. Lt. William Turnbull to Topographical Bureau, July 31, Sept. 2, Nov. 4, 1828, *ibid.*; U. S., Cong., House, *Survey—Kentucky River*, H. Doc. No. 58, 20th Cong., 1st Sess., 1829, pp. 1-3; U.S. Army Corps of Engineers, *Kentucky River Surveyed under the Direction of Lt. Turnbull by Lieuts. Grayson and Buford* (8 maps, Washington, DC, 1829). Copies of these maps are at Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers; and Inland Rivers Library, Cincinnati, OH.
28. U.S., Cong., House, *Survey—Kentucky River*, H. Doc. 58, 20th Cong., 1st Sess., 1829, pp. 1-3. A perch of stone measures about twenty-five cubic feet.
29. *Ibid.*; Frankfort *Commonwealth*, Feb. 11, 1835; Carleton Jackson, "The Internal Improvement Vetoes of Andrew Jackson," *Tennessee Historical Quarterly* 25(Fall 1966):261-79.
30. Jackson, "Internal Improvement Vetoes of Andrew Jackson," pp. 261-79; Frankfort *Commonwealth*, Dec. 27, 1834; Leland R. Johnson, *Engineers on the Twin Rivers: A History of the U. S. Army Engineers, Nashville District* (Nashville: US Army Engineer District, 1978), pp. 61-74. During Jackson's administration, Congress appropriated \$155,000 for wingdam construction on Cumberland River; this was a federal project supervised by the Corps of Engineers, not a cost-shared state project.
31. *Kentucky House Journal*, 1830-1831, pp. 12-16.
32. *Ibid.*, pp. 156-65.
33. *Kentucky House Journal*, 1832-1833, pp. 13-14. Breathitt was lieutenant governor under Metcalfe and after becoming governor he died on Feb. 21, 1834. Whig Richard A. Buckner was from Green County. See Lowell Harrison, "John Breathitt," in Kleber, ed., *Kentucky Encyclopedia*, p. 115.
34. Thomas D. Clark, "The Lexington and Ohio Railroad—A Pioneer Venture," *Register of Kentucky Historical Society* 31(Jan. 1933):9-28; *Kentucky House Journal*, 1832-1833, pp. 232-40.
35. *Kentucky House Journal*, 1832-1833, pp. 83-85.
36. *Ibid.*, p. 312-15.
37. Clark, "The Lexington and Ohio Railroad," p. 17; Frankfort *Commonwealth*, Sept. 27, 1834, Jan. 2, 1835, May 7, 1839.
38. Helen B. Crocker, *The Green River of Kentucky* (Lexington: University Press of Kentucky, 1976), p.14-17; *Kentucky House Journal*, 1832-1833, pp. 13-14; *Kentucky House Journal*, 1833-1834, p. 17; U.S., Cong., Sen., *Reports and Draughts of Surveys for the Improvement of Harbors and Rivers and the Construction of Roads and Canals*, I, (Washington, DC: Gales and Seaton, 1839), 411-12, prints Weston's analysis.

39. U.S., Cong., Sen., *Reports and Draughts of Surveys for the Improvement of Harbors and Rivers*, I, 411-12.
40. Monongalia Navigation Company Papers, Virginia State Archives, Richmond, VA; Dorothy Davis, *John George Jackson* (Parsons, WV: McClain Printing Co., 1976), pp. 300-18; Leland R. Johnson, *The Headwaters District: A History of the Pittsburgh Engineer District*, U.S. Army Corps of Engineers (Pittsburgh: US Army Engineer District, 1979), pp. 48-51.
41. Antes Snyder, "Pittsburgh—Her Waterways and Her Railways," *Transactions of the American Society of Civil Engineers* 28 (1903):24-25; Moncure Robinson, "Early Surveys and Reports in Reference to the Transmission of Trade across the Allegheny Mountains," *Transactions of the American Society of Civil Engineers* 15(1886):181-22; Johnson, *Headwaters District*, pp. 88-90.
42. Crocker, *Green River*, pp. 16-17; Frankfort *Commonwealth*, Nov. 12, 1833, prints the Lacock-Steailey report. Members of the 1833 Green River Commission were James R. Skiles, Stephen Ashley, Dillis Dyer, and Simpson Stout. Engineer Alonzo Livermore subsequently increased Green River lock dimensions to 160 by 36 feet. By comparison, Louisville and Portland Canal locks on the Ohio were 183 by 52 feet and Kentucky River locks were 145 by 38 feet.
43. *Kentucky House Journal*, 1833-1834, pp. 16-17, 77; Crocker, *Green River*, pp. 18-19; Frankfort *Commonwealth*, Dec. 27, 1834.
44. Frankfort *Commonwealth*, Sept. 27, Oct. 11, 1834; Willard R. Jillson, "Early Political Papers of Governor James Turner Morehead," *Register of Kentucky Historical Society* 23(Jan. 1925):36-61; Clark, "Lexington and Ohio Railroad," pp. 17-18.
45. Clark, "Lexington and Ohio Railroad," pp. 17-18; Frankfort *Commonwealth*, Oct. 25, 1834, Jan. 2 and 28, 1835.
46. *Kentucky House Journal*, 1835, pp. 18-22.
47. Frankfort *Commonwealth*, Jan. 10 and 14, 1835.
48. Frankfort *Commonwealth*, Jan. 24, Feb. 11 and 28, 1835.
49. Frankfort *Commonwealth*, Feb. 28, 1835; *Kentucky Senate Journal*, 1835-1836, appendix, pp. 1-9; *Kentucky House Journal*, 1836-1837, pp. 189-95, 217-19.

3. SCIENTIFIC MAN

1. Orlando Brown quoted from Frankfort *Commonwealth* editorial, Oct. 22, 1839.
2. Frankfort *Commonwealth*, May 2, Nov. 21, Dec. 5, Dec 26, 1835, and Mar. 29, Dec. 12, 1837. The *Empress's* record set on the run from New Orleans to Louisville was six days, seventeen hours.
3. Frankfort *Commonwealth*, Jan. 24, 1835.
4. G. Glenn Clift, "The Old Master, Colonel Orlando Brown, 1801-1867," *Register of Kentucky Historical Society* 49(Jan.1951):5-24; *Kentucky Senate Journal*, 1835-1836, appendix, pp.1-9; Frankfort *Commonwealth*, Feb. 28, Mar. 21, May 16, 1835, and Mar. 2, 1841. Elected to Congress in 1835, James Harlan left the Board and was replaced by Edward P. Johnson. Brown Landing at Kentucky River Mile 32.6 later was known as Blue Wing Landing after a famous steamboat that landed there. Tradition says Gratz was named for Gratz Brown. The Board president received \$1,000 per year and members received \$3 per each day of service plus expenses. *Kentucky Acts*, 1834-35, pp. 285-94, prints the act of Feb. 28, 1835, creating the Board of Internal Improvement; it also appropriated \$100,000 for improving Kentucky River navigation.
5. *Kentucky Senate Journal*, 1835-1836, appendix, pp.1-9, 15-16; Frankfort *Commonwealth*, Feb. 28 and Mar. 21, 1835. Built by Alabama with federal funding assistance in 1830-32, Muscle Shoals canal was 15 miles long and had 20 locks and 6 dams completed at a cost averaging

\$40,000 per mile of canal; it was not successful. See Leland R. Johnson, "Muscle Shoals Canal, Tennessee River," *Military Engineer* 63(July 1971):260-65.

6. Napoleon Bonaparte Buford (1807-1883) graduated at West Point in 1827 and was in the 3rd Artillery when the Chief Engineer selected him for the 1828 Kentucky River survey. His parents moved from Woodford County to Rock Island, Illinois, and opened the first store on Main Street in Rock Island; their Rock Island mansion still stands. During the Civil War, Buford became major general in the Union Army. See Roald Tweet, *A History of the Rock Island District, Corps of Engineers* (Rock Island, IL: US Army Engineer District, 1975), pp. 17-18.

7. *Kentucky Senate Journal, 1835-1836*, appendix, pp. 35-40, prints Buford's survey report. Eli Cleveland's Landing became Clays Ferry at River Mile 170 near the present Interstate 75 bridges. Cleveland operated a hemp mill, making ship cordage and sails. Green Clay purchased the ferry from Valentine Stone in 1798 and the Clay family operated the ferry until 1865 when a turnpike company built a toll bridge. Napoleon Buford to Orlando Brown, Oct. 5, 1835, Orlando Brown Papers, Filson Club, Louisville, KY, states 41 flatboats carrying 73,600 bushels of coal went downriver in the winter of 1834-35 from Three Forks to Cleveland's Landing and Frankfort.

8. *Frankfort Commonwealth*, Sept. 19, 1835; *Kentucky Senate Journal, 1835-1836*, appendix, pp. 35-40.

9. *Kentucky Senate Journal, 1835-1836*, appendix, pp. 1-34.

10. *Frankfort Commonwealth*, Sept 19, 1835; Napoleon Buford to Orlando Brown, Oct. 5, 1835, Orlando Brown Papers, Filson Club, Louisville, KY.

11. *Kentucky Senate Journal, 1835-1836*, appendix, pp. 13-34, prints Baker's report of Jan. 19, 1836, and *Kentucky House Journal, 1835-1836*, appendix, pp. 49-94, prints his Feb. 23, 1836, report.

12. See Baker's reports listed in note 11 above; Baker measured the gradient at 44.925 feet from Frankfort to Carrollton; he measured the Kentucky's channel at 360 feet wide and 12 feet deep at its mouth; four miles upstream at Horseshoe Bend it narrowed and became shallower.

13. See note 11 above.

14. *Kentucky House Journal, 1835-1836*, appendix, p. 50. Floods fifty-feet deep were not uncommon.

15. *Kentucky House Journal, 1835-1836*, appendix, pp. 55-62.

16. *Ibid.*, pp. 62-63.

17. *Ibid.*, pp. 64-66.

18. *Ibid.*, pp. 69-71.

19. *Ibid.*, pp. 66-67, 75-79.

20. *Kentucky Senate Journal, 1835-1836*, appendix, p.15.

21. *Ibid.*, pp. 13-34.

22. *Ibid.*

23. *Ibid.*

24. *Ibid.*; Report of Committee on Expenditures of the Board of Internal Improvement, *Legislative Documents, 1848*, pp. 661-64, lists payments for land to H. Blanton, H. Marshall, and S. Todd in 1836 and to F. R. Sharp in 1841 for land at Lock 5.

25. *Ibid.*

26. *Ibid.*

27. *Kentucky House Journal, 1835-1836*, appendix, pp. 84-93. Taking advantage of the low gradient, railroads and highways subsequently were built along Baker's canal route.

28. *Kentucky Senate Journal*, 1835-1836, appendix, pp. 1-9.
29. *Ibid.*; *Kentucky House Journal*, 1836-1837, pp. 71-82; Napoleon Buford to Orlando Brown, Oct. 5, 1835, Orlando Brown Papers, Filson Club, Louisville, KY.
30. *Kentucky House Journal*, 1836-1837, appendix, p. 71. *Kentucky Acts*, 1835-36, pp. 527-40, prints act of Feb. 29, 1836, authorizing the Governor to appoint a President and members of the Board of Internal Improvement and appropriating \$200,000 for improving the Kentucky River. Board members of 1836 were William Owsley, Samuel Daviess, and Manlius V. Thomson. Chilton Allan became Board president in 1837.
31. *Ibid.*, pp. 72-73; Frankfort *Commonwealth*, June 24, 1845, prints Skiles' memoirs; J. Roscoe Howell, "Ashbel Welch, Civil Engineer," *Proceedings of the New Jersey Historical Society* 79 (1961):251-63; William Dzombak to Charles E. Parrish, Mar. 23, 1994, encloses Welch biographical sources, Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers. Sylvester's younger brother Ashbel Welch became a civil engineer also, designing pioneer projects in New Jersey. Frankfort *Commonwealth*, Mar. 8, 1837, prints Kentucky act of Feb. 23, 1837, increasing the chief engineer's salary to \$4,000 annually and describing his duties.
32. *Kentucky House Journal*, 1836-1837, pp. 71-73; Frankfort *Commonwealth*, Oct. 3, 1843, prints Matthew Stealey's autobiography. *Kentucky Senate Journal*, 1837-1838, appendix, pp. 39-40, notes an act of Feb. 23, 1837, authorized the Board to employ resident and assistant engineers at salaries they agreed on, providing the engineers were paid no more than a \$20,000 total. In addition to Welch, the engineers and their annual salaries in Dec. 1837 were: *Resident engineers*: Matthew Stealey (\$3,000); Alonzo Livermore (\$3,000); Napoleon Buford (\$2,500); Henry J. Eastin (\$1,600); Antes Snyder (\$2,500); William B. Foster, Jr. (\$2,500); *Assistant engineers*: George R. Eichbaum (\$1,300); William Moore (\$1,100); David Mitchell, Jr. (\$1,200); Charles F. Taylor (\$800). By law, the President of the Board of Internal Improvement was paid \$1,000 a year and its members received \$3 per day worked.
33. *Kentucky Senate Journal*, 1837-1838, appendix, pp. 51-54.
34. *Kentucky House Journal*, 1836-1837, appendix, p. 73.
35. *Ibid.*, pp. 94-97.
36. *Ibid.*; "Specifications of the Locks and Dams to be Constructed for the Kentucky River Navigation," 1836, Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers.
37. *Ibid.*; *Kentucky House Journal*, 1836-1837, appendix, pp. 73, 94.
38. *Kentucky House Journal*, 1836-1837, appendix, pp. 189-219; Collins, *History of Kentucky*, I, 544.
39. Frankfort *Commonwealth*, July 6, 1836; *Kentucky House Journal*, 1842, pp. 271-98, prints the contracts.
40. *Kentucky House Journal*, 1842, pp. 271-98; Collins, *History of Kentucky*, I, 550. The contractor for Nos. 4 and 5, Matthews and Wilson, was a joint venture of Wilson Knott, David Mahan, James F. McCague, John Matthews, and James Wilson.
41. *Kentucky Senate Journal*, 1837-1838, appendix, p. 73; Stealey's report of Oct. 1837 on hydraulic lime near Irvine is printed in Frankfort *Commonwealth*, Nov. 15, 1837.
42. *Kentucky House Journal*, 1836-1837, appendix, pp. 73, 90.
43. *Ibid.*, pp. 73-75.
44. *Ibid.*, pp. 90-99.
45. *Kentucky House Journal*, 1836-1837, pp. 75-77, 80, 189-219; Frankfort *Commonwealth*, Nov. 1, 1837, states Illinois and Indiana bonds sold for six percent, while Kentucky bonds offered no more than five percent, and brokers preferred the higher-paying bonds.
46. "Report on the Expenditures of the Board of Internal Improvements," *Kentucky House Journal*, 1836-1837, pp. 189-219.

47. *Ibid.*, p. 194.; *Frankfort Commonwealth*, Jan. 25, 1837, prints editorial on the audit.
48. *Frankfort Commonwealth*, Jan. 4, Apr. 25, Nov. 1, 1837. The college had 200 students in 1837. Thornton F. Johnson and Jacob Ammen, West Point graduates, and Mordecai Yarnall served as professors of mathematics and engineering. D. S. Burnet was College president, and faculty included W. Hunter, S. G. Mullins, T. Vincent, and V. V. Baldwin. The reduced demand for engineers during the 1840s ended this engineering school. Bacon College moved in 1841 to Harrodsburg, while Thornton Johnson organized and became president of Western Military Institute in 1847; see *Frankfort Commonwealth*, June 3, 1841, and May 18, 1847; Robert Snyder, *A History of Georgetown College* (Georgetown, KY: Georgetown College, 1979), pp. 14-17; Leland W. Meyer, *Georgetown College: Its Background and a Chapter in its Early History* (Georgetown, KY: Georgetown College, 1929), pp. 48-63.
49. *Kentucky Senate Journal, 1837-1838*, appendix, pp. 3-75. Allan was Secretary of State, Skiles and Wood represented western Kentucky, and Thomson became lieutenant governor in the Letcher administration, 1840-44.
50. *Ibid.*; Remini, *Andrew Jackson and the Course of American Democracy, 1833-1845*, p. 318; *Frankfort Commonwealth*, July 26, Sept. 6, 1837; *Frankfort Commonwealth*, Jan. 3, 1838, prints Sinking Fund commissioners report on the \$850,000 investment in internal improvements.
51. *Kentucky Senate Journal, 1837-1838*, appendix, pp. 3-75; *Frankfort Commonwealth*, Nov. 1, 1837, lists Palmer & Guion as contractors for Licking River Locks Nos. 1 and 2; Haslett & Grant for No. 3, and John B. Miles for Nos. 4 and 5. Their bids totaled \$7,127 less than the engineers' cost estimates.
52. *Kentucky Senate Journal, 1837-1838*, appendix, pp. 20-21

4. A VALENTINE TO THE LEGISLATURE

1. *Frankfort Commonwealth*, Sept. 12, 1838, quotes Chief Engineer Sylvester Welch's toast to internal improvements; *Frankfort Commonwealth*, Mar. 29, July 26, Sept. 6, 1837; *Kentucky House Journal, 1839-1840*, p. 69. *Kentucky Acts, 1836*, pp. 415-17, Feb. 29, 1836, established a state sinking fund to pay interest on state bonds; *Kentucky Acts, 1837*, pp. 319-22, provided for investing federal revenue surplus.
2. *Kentucky House Journal, 1839-1840*, p. 512; *Frankfort Commonwealth*, Mar. 29, July 26, Sept. 6, 1837, and Dec. 5, 1838. John Tilford also was president of Northern Kentucky Bank.
3. *Frankfort Commonwealth*, Nov. 14, 1838, reported: "Old mother Earth says she never was so dry in all her life as she has been during the last summer; she was almost parched to death."
4. *Kentucky House Journal, 1838-1839*, appendix, pp. 81-91; *Frankfort Commonwealth*, May 30, 1838; *Kentucky Acts, 1837*, p. 250, ac Feb. 16, 1838, approved sale of \$1,250,000 of bonds at six percent. American Life Insurance and Trust Company of New York, purchaser of the bonds, sold them in London's capital market.
5. *Kentucky House Journal, 1838-1839*, appendix, pp. 143-45.
6. *Ibid.*, pp. 53, 126-27. Snyder contracted with Hiram Hibbard for \$350 to clear East Fork of Goose Creek and with Elhanan Murphy for \$283 to clear Collins Fork. *Kentucky Acts, 1848*, p. 58, appropriated \$600 for additional work at the Narrows on South Fork by Job Allen, James White, and George Gregory.
7. *Frankfort Commonwealth*, June 27, 1838, prints George Stealey's report of June 1, 1838, on mineral resources.
8. *Kentucky House Journal, 1838-1839*, appendix, pp. 55-56; *Frankfort Commonwealth*, Jan. 9, 1839, printed Louisville *Public Advertiser's* comment that the Board had underestimated Louisville's coal market: "The cost of improving the Kentucky River must increase as operations are extended upward, because ripples are more numerous, the fall of the stream greater, and more dams will be required to secure the desired slackwater navigation," the newspaper observed, but added that if total Kentucky River slackwater project costs did not

exceed \$3 million, traffic tolls and power revenue should rise to \$300,000 a year, generating a ten percent annual return on the investment.

9. Frankfort *Commonwealth*, Jan. 31, Nov. 21, Nov. 28, 1838; Crocker, *Green River*, pp. 19-20; *Kentucky House Journal*, 1838-1839, appendix, pp. 7-60. Part of Ohio's canal system, the Muskingum project consisted of eleven locks and ten dams connecting with the state canal at Zanesville. The Monongahela River Navigation Company built five 180- by 40-foot locks and dams, and Indiana built one lock and dam on the Wabash. The Wabash project proved unsuccessful, and the Muskingum project was completed by Ohio and still operated for recreation in 1998. The Monongahela project at times carried more traffic than the Ohio River or the Panama Canal; its locks and dams were expanded many times and were undergoing further enlargement in 1998.

10. *Kentucky House Journal*, 1838-1839, appendix, p. 81.

11. Frankfort *Commonwealth*, Mar. 20, 1839; *Kentucky House Journal*, 1839-1840, p. 232. The state awarded the contract for No. 6 to Cummings, Power, Sill & Co.; for No. 7 to Henry and McClelland; and for No. 8 to Samuel Fitch. The state aborted the contracts, however, and no construction was accomplished.

12. Frankfort *Commonwealth*, June 28, Nov. 5, 1839; *Kentucky House Journal*, 1839-1840, p. 133. The proposed locks and dams on Mud River and upper Barren River had the same 120 by 22-foot dimensions inside the lock chamber as the lock proposed on the Kentucky's South Fork.

13. Frankfort *Commonwealth*, Oct 3, 1839; *Kentucky House Journal*, 1839-1840, p.191-96.

14. *Kentucky House Journal*, 1839-1840, p. 486, printed also in Frankfort *Commonwealth*, Mar. 24, 1840.

15. *Ibid.*

16. *Ibid.*

17. *Ibid.*, pp. 187-206. See William R. McKee's obituary in Frankfort *Commonwealth*, June 1, 1847.

18. *Kentucky House Journal*, 1839-1840, pp. 187-206; *Kentucky House Journal*, 1838-1839, p. 355; Report of Committee on Expenditures of Board of Internal Improvement, *Legislative Documents*, 1848, p. 663, lists additional superintendents: N. A. Spears, A. Mathews, J. Montfort, Robert Martin, S. Todd, A. Sharp, J. Rowden, H. Dewey.

19. Annual Report of the Board of Internal Improvement, *Legislative Documents*, 1841, pp. 239-95.

20. Frankfort *Commonwealth*, Oct. 15, Nov. 5, 1839, and Mar. 10, 1840; *Kentucky Acts*, 1840, pp. 271-73, approves giving state bonds as payment to contractors for work they performed.

21. Frankfort *Commonwealth*, Oct. 3, Nov. 19, 26, 1839; Will D. Gilliam, Jr., "Robert Perkins Letcher, Whig Governor of Kentucky," *Filson Club History Quarterly* 24(Jan. 1950):6-27. Whigs thought the injection of internal improvements into politics emanated from President Van Buren's administration, specifically from Postmaster General Amos Kendall, that "most vicious of all demagogues."

22. *Kentucky House Journal*, 1839-1840, pp. 193-268.

23. *Ibid.*, pp. 265-68. Dams Nos. 3, 4, and 5 had a 66-foot base width.

24. *ibid.*, p. 292; Frankfort *Commonwealth*, Mar. 16, 1841.

25. *Kentucky House Journal*, 1839-1840, pp. 265-68.

26. *Ibid.*; Report of Committee on Expenditures of Board of Internal Improvement, *Legislative Documents*, 1848, p. 662, lists payments for clearing trees from the slackwater pools to J. H. Smith, A. G. Cammack, E. J. Carico, H. Dewey, J. Rowden, D. Byrne, and George Crumbaugh.

27. Frankfort *Commonwealth*, Oct. 15, 1839. The hydraulic cement was manufactured at Louisville, not in the hills near Frankfort. Frankfort *Commonwealth*, Nov. 14, 1863, identified the British foreign minister who visited the locks and compared them with Roman engineering as Lord Morpeth.

28. *Kentucky House Journal, 1840-1841*, p. 240; *Frankfort Commonwealth*, Jan. 12, Jan. 19, Feb. 18, 25, Mar. 3, 1840. Samuel Steele served as captain also of the *Kentucky, Little Mail*, and *Grey Eagle*. How he steamed the *New Argo* up and down the river past Locks and Dams Nos. 2 and 3 in January is a mystery. It perhaps passed through openings left in the dams during construction for the purpose, but the resolution enacted aboard the boat indicates the guests saw the locks in operation.
29. *Frankfort Commonwealth*, Jan. 14, 19, 1840.
30. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 289-92.
31. *Ibid.*; *Kentucky House Journal, 1841-1842*, p. 176, Matthew Stealey said the log jam took out part of Dam No. 2's lower slope, all of Dam No. 3's, and half the covering planks of Dam No. 4. In making repairs, instead of using 15-inch spikes to pin down the timbers, Stealey installed long tie bolts of inch-and-a-quarter square iron secured by keys in lower timbers and therefore less subject to loosening by tremors of the dams during high water.
32. *Frankfort Commonwealth*, Feb. 18, 25 and Mar. 3, 1840; in *Journal of the Franklin Institute* 31(May 1841):377-79, Stealey reported he rigged the lockgates to pass Captain Armstrong and the *New Argo*, the first boat to lock through to Frankfort on Feb. 14, 1840.
33. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 289-92; *Kentucky House Journal, 1841-1842*, pp. 178-79. Floodgates were similar to Josiah White's beartraps and had two leaves placed in the upper entrance to the locks; the beartraps dropped to horizontal position, releasing water to sluice sediment from lock chambers. These were installed at Lock 2 but tended to rise on their own and obstruct boat passage, so they were spiked down. Operation proved that opening valves in the lockgates created sufficient current to prevent major sediment deposits in lock chambers.
34. *Frankfort Commonwealth*, Dec. 17, 1839, prints the debate.
35. *Kentucky House Journal, 1839-1840*, p. 520.
36. *Frankfort Commonwealth*, July 7, 1840; *Kentucky House Journal, 1840-1841*, pp. 218-219.
37. *Kentucky House Journal, 1840-1841*, pp. 218-219; Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 239-95.
38. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 239-95. *Kentucky Acts, 1841*, p. 66, directed the Board of Internal Improvement to "dismiss all Engineers not absolutely required to carry on the public works."
39. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 251-53.
40. *Ibid.*, pp. 289-92.
41. *Frankfort Commonwealth*, Dec. 8, 20, 1840; Gilliam, "Robert Perkins Letcher," pp. 6-27.
42. *Kentucky House Journal, 1840-1841*, pp. 112-116; also printed in *Frankfort Commonwealth*, Dec. 29, 1840.
43. Clark, "Lexington and Ohio Railroad," p. 20; *Kentucky House Journal, 1839-1840*, appendix, pp. 81-103.
44. Clark, "Lexington and Ohio Railroad," pp. 20-28.

5. THE ELEVENTH HOUR

1. *Kentucky House Journal, 1841-1842*, pp. 186-87, quotes Matthew R. Stealey.
2. *Ibid.*, p. 180; *Frankfort Commonwealth*, Dec. 7, 1841. No lives were lost in the accident, and the boat carried no freight except the passengers' baggage. *Kentucky Acts, 1842*, pp. 44-45, directs the Board to remove the *New Argo's* wreck as an obstruction to navigation.

3. *Frankfort Commonwealth*, Mar. 23, 1841; Gilliam, "Robert Letcher Perkins," pp. 6-27; *Kentucky Acts*, 1843, p. 35. The state expended \$2,126,000 on turnpikes and bridges, \$215,000 on Lexington and Ohio Railroad, \$1,554,000 on slackwater projects, \$15,000 on descending navigation, and \$101,000 on surveys and engineering. To replenish the Sinking Fund, the legislature raised property taxes from ten cents per hundred dollars valuation to fifteen cents per hundred.
4. *Kentucky House Journal*, 1842-1843, p. 358; *Frankfort Commonwealth*, Mar. 2, 1841; *Kentucky Acts*, 1842, pp. 95-96. In 1842, the legislature also appropriated \$420,000 for repairing, completing, and maintaining public works including turnpike roads and provided \$100,000 for rebuilding the Lexington and Ohio Railroad.
5. *Kentucky House Journal*, 1841-1842, pp. 180-87.
6. *Ibid.*
7. *Ibid.*
8. *Ibid.*, pp. 175-87; *Kentucky House Journal*, 1843-1844, pp. 169-70. William Root bought Barbour's oxen, boats, wheelbarrows, and hand tools at public auction.
9. *Kentucky House Journal*, 1841-1842, pp. 175-87.
10. *Ibid.*
11. *Ibid.*
12. Special Report in Relation to Claim of Joseph Barbour, *Legislative Documents*, 1843, pp. 399-411.
13. *Kentucky House Journal*, 1841-1842, pp. 180-87.
14. *Ibid.*
15. *Ibid.*; *Frankfort Commonwealth*, Nov. 2, 23, 30, 1841. Thanksgiving Day was not an official annual holiday until after the Civil War. *Kentucky House Journal*, 1842-1843, pp. 199-201, lists final project dimensions: No. 1 had 10,504 perches (25 cu. ft. per perch) of lock stonemasonry and its dam was 525 feet long, 25 feet high, and 80 feet base; No. 2 had 8,240 perches masonry and the dam was 439 feet long, 21 feet high, and 80 feet base; No. 3 had 7,999 perches masonry and the dam was 464 feet long, 21 feet high, and 66 feet base; No. 4 had 9,548 perches masonry and the dam was 530 feet long, 20 feet high, and 66 feet base; and No. 5 had 8,107 perches masonry and the dam was 373 feet long, 27 feet high, and 66 feet base.
16. *Frankfort Commonwealth*, Jan. 25, 1842, prints Kentucky House report urging reduction of Board expenditures and of its engineer staff to a number "consistent with the efficient management of the public works." Antes Snyder returned to Pennsylvania; see his "Pittsburgh—Her Waterways and Her Railways," *Transactions of the American Society of Civil Engineers* 28 (1903):24-25. Foster became clerk in a Cincinnati steamboat office serving Kentucky River boats; Buford moved to Rock Island, IL, and became a Union Army general during the Civil War; Alonzo Livermore worked for the Corps of Engineers on the Ohio, Upper Mississippi, and Osage river projects until the 1870s. *Frankfort Commonwealth*, June 19, 1849, and Apr. 30, 1850, mentions George Stealey's activities, and the issues of Aug. 6, 1845 and Oct. 3, 1849, mentions Matthew Stealey's post-engineering career; *Kentucky Acts*, 1848, p. 167, pays Matthew Stealey for designing the state penitentiary.
17. Special Report in Relation to Claim of Joseph Barbour, *Legislative Documents*, 1843, pp. 399-411.
18. *Ibid.*; *Kentucky House Journal*, 1841-1842, pp. 186-87.
19. Special Report in Relation to Claim of Joseph Barbour, *Legislative Documents*, 1843, pp. 399-411. In *Kentucky House Journal*, 1843-1844, pp. 170-73, Metcalfe wrote: "It would have been most gratifying to the Board, to have permitted all the prominent derelictions of this Contractor to pass into swift oblivion without further notice; but his persevering efforts, stimulated, perhaps, by his successes heretofore, to recover from the State large sums of money to which he has not a shadow of claim, founded upon justice, leaves the Board without an alternative between this expose, and downright concealment from the rightful authority,

- of information so indispensable to their correct action upon the claims of this individual.”
20. Annual Report of the Board of Internal Improvement, 1843, *Legislative Documents, 1844*, p. 477; *Kentucky Acts, 1837*, p. 318; *Kentucky Acts, 1838*, p. 304; *Kentucky Acts, 1843*, p. 240.
 21. Special Report of the Board of Internal Improvement, *Legislative Documents, 1844*, p. 391; *Frankfort Commonwealth*, Mar. 12, 1844. Licking River contractors were James S. Law, Robert Williams, Palmer & Guion, J.T. and J. C. Ham companies.
 22. Special Report of the Board of Internal Improvement, *Legislative Documents, 1844*, p. 508.
 23. *Frankfort Commonwealth*, Mar. 15, 1844.
 24. Report of Committee on Expenditures of Board of Internal Improvement, *Legislative Documents, 1848*, pp. 665-76.
 25. Special Report of the Board of Internal Improvement, *Legislative Documents, 1846*, pp. 647-48; *Kentucky House Journal, 1840-1841*, pp. 150-51, reports claim of Joel Thomasson of Franklin County for damage to his mill on Glenn's Creek. Annual Report of the Board of Internal Improvement, *Legislative Documents, 1847*, pp. 553-55, describes claim by William Rowlett that Dam No. 2's slackwater injured his land and mill on Severn Creek. *Kentucky House Journal, 1846-1847*, pp. 201-04, relates claims of Rowlett on Severn Creek and Wesley Dean on Eagle Creek. Procedures for paying landowner damages were established in acts of Feb. 21, 1840, Feb. 10, 1845, and Feb. 23, 1846.
 26. *Frankfort Commonwealth*, Feb. 2, 1841, reports the *Transit* excursion to Shaker Ferry; *Frankfort Commonwealth*, Apr. 6, 1841, and June 13, 1845, reports the *Ocean's* trips.
 27. *Frankfort Commonwealth*, Feb. 18, 1842; Annual Report of the Board of Internal Improvement, 1844, *Legislative Documents, 1845*, pp. 551-52. The Board decided tolls were due, whether boats passed through the locks or over the dams.
 28. *Frankfort Commonwealth*, Nov. 22, 1842.
 29. Annual Report of the Board of Internal Improvement, 1844, *Legislative Documents, 1845*, p. 69-70.
 30. Family Register of Joseph R. Underwood, 1834-1850, p. 75, Kentucky Library, Western Kentucky University, Bowling Green, KY.
 31. *Frankfort Commonwealth*, Dec. 31, 1844, and Apr. 1, Sept. 30, 1845; *Frankfort Commonwealth*, Sept. 12, Nov. 7, 1843, and July 2, 1844, reviews trade carried by the *Little Mail*.
 32. *Frankfort Commonwealth*, May 23, June 20, Nov. 7, Dec. 12, 1843, reviews operations of the *Letcher* and *Metcalfe*. *Frankfort Commonwealth*, Oct. 11, 1842, reported the *Ocean* made the trip from Louisville to Frankfort in 23 hours.
 33. Annual Report of the Board of Internal Improvement, 1844, *Legislative Documents, 1845*, p. 558.
 34. *Ibid.*, p. 564. Scott Company began sawmill operations at Dam No. 4 in 1847; Harbison and Harrod Company took over the sawmill in 1851 and L. W. Harrod owned it after 1854; see *Legislative Document No. 5, 1860*, p. 4. In 1878 the Kentucky River Mills organized to use Dam No. 4's water power for manufacturing hemp bagging and twine. *Kentucky Acts, 1848*, pp. 29-30, authorized the Board to purchase land fronting the river next to Lock and Dam No. 4 for the water-power race and as space for project repairs.
 35. *Kentucky House Journal, 1843-1844*, pp. 542-43. The first lock keepers at No. 1 were contractor Joseph Barbour until Sept. 9, 1843, followed by A. H. Lathrop; at No. 2 were H. Dewey until Jan. 4, 1844, followed by N. L. Oliver; at No. 3, Joseph Rowden; at No. 4, Andrew Sharp; and Matthew Skelton at No. 5. Report of Committee on Expenditures of Board of Internal Improvement, *Legislative Documents, 1848*, p. 664 and 676, list payments for lockhouses of \$840 to Barbour, \$58.82 to James S. Evans, and \$900 to J. Monfort for building three lockhouses in 1843. *Frankfort Commonwealth*, Feb. 6, 1844, lists R. H. Chittenden as first Collector of tolls.

36. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 244-47, prints the first rules and regulations for Kentucky River lock keepers, collectors, and boat captains. Because the keeper at Lock No. 1 had to collect tolls in addition to operating the lock, he received higher pay than other lock keepers. Working on commission, the Collector became a political job, changed with every administration. Most toll receipts and many cargo manifests, 1843-1868, remain on file in Board of Internal Improvement Papers, Accounts of the Auditors Office, Kentucky State Library and Archives, Frankfort, KY.
37. Ibid. Refusing to assist lock keepers made boat captains subject to \$20 fines. Annual Report of the Board of Internal Improvement, 1842, *Legislative Documents, 1843*, p. 478, reports that lock-keepers can supplement their salaries by raising "a good crop of corn, vegetables and hay; have a good garden; keep a horse and cow; raise a few pigs and fowls."
38. Annual Report of the Board of Internal Improvement, 1840, *Legislative Documents, 1841*, pp. 244-47.
39. Frankfort *Commonwealth*, Dec. 7, 1841.
40. Annual Report of the Board of Internal Improvement, 1842, *Legislative Documents, 1843*, pp. 297-98.
41. Ibid. The Welch-Stealey \$700,000 cost estimate of 1836, however, compares well with the \$800,000 actual construction costs, which slowly increased to \$900,000 through later payments of damage claims from contractors and landowners. If state funding had been sufficient to complete construction by 1838 as planned in 1836, the Welch-Stealey cost estimate of 1836 might well have been accurate to the dollar.
42. Frankfort *Commonwealth*, Feb. 6, 1844.
43. *Kentucky House Journal, 1843-1844*, pp. 542-43.
44. Ibid.
45. Frankfort *Commonwealth*, Sept. 12, 1843, reprints Stealey's report from *Louisville Journal*.
46. Ibid.
47. Frankfort *Commonwealth*, Oct. 3, 1843; *Kentucky House Journal, 1843-1844*, pp. 542-43.
48. Frankfort *Commonwealth*, Sept. 12, 1843.
49. Frankfort *Commonwealth*, Aug. 20, 1843; Annual Report of the Board of Internal Improvement, 1845, *Legislative Documents, 1846*, pp. 486-88.
50. Annual Report of the Board of Internal Improvement, 1845, *Legislative Documents, 1846*, pp. 486-88.
51. Annual Report of the Board of Internal Improvement, 1844, *Legislative Documents, 1845*, pp. 401-02.
52. Ibid.; Frankfort *Commonwealth*, Feb. 6, 1844. Frankfort *Commonwealth*, Sept. 29, 1846, reported that from January through September 1846 the Board collected \$25,136 in tolls on the Kentucky River and returned \$17,456 of this to the Sinking Fund.
52. Annual Report of the Board of Internal Improvement, 1844, *Legislative Documents, 1845*, p. 552-54; Frankfort *Commonwealth*, Dec. 1, 1846.
53. Report of Committee on Expenditures of Board of Internal Improvement, *Legislative Documents, 1848*, pp. 750-51; Frankfort *Commonwealth*, Apr. 1, 1845. Highest returns from a turnpike was the Maysville Road which paid \$54,514.
54. *Kentucky Senate Journal, 1843-1844*, pp. 237-39; *Kentucky Acts, 1844*, p. 52.
55. *Richmond Chronicle*, Mar. 7, 1846, quoted in Frankfort *Commonwealth*, Mar. 24, 1846; see also Frankfort *Commonwealth*, Mar. 17, 1846. The boat went upriver on the flood of Mar. 1846, reported as the highest flood on the Upper Kentucky since 1819: "Log, cabins, and sawmills were floating majestically in the current."

6. SLACKWATER AND DAMS

1. Owen G. Cates quoted in Annual Report of the Board of Internal Improvement, 1849, *Legislative Documents*, 1850, pp. 518-19.
2. Frankfort *Commonwealth*, Oct. 26, Dec. 14, 1847.
3. Ibid.
4. Frankfort *Commonwealth*, May 12, 1846.
5. Frankfort *Commonwealth*, June 9, 1846.
6. *Kentucky House Journal*, 1846, pp. 33-35. Interest in resuming construction of the Licking River locks and dams also revived; see *Kentucky House Journal*, 1847, pp. 162-64. Sylvester Welch became chief engineer of the Covington and Lexington Railroad and died at Frankfort on Dec. 6, 1852; see Frankfort *Commonwealth*, Dec. 17, 1852.
7. Frankfort *Commonwealth*, Jan. 9, 1846, prints Governor Owsley's message.
8. *Kentucky Acts*, 1847, pp. 68-71.
9. Frankfort *Commonwealth*, June 9, 1846.
10. Frankfort *Commonwealth*, May 4, Sept. 7, 1847.
11. Frankfort *Commonwealth*, Dec. 29, 1846, and Feb. 9, May 18, 1847.
12. Frankfort *Commonwealth*, Nov. 30, 1847, and Aug. 1, Nov. 7, 1848. Captain D. Campbell piloted the *Monterey* and Captain Clancey the *Greenwood*.
13. Frankfort *Commonwealth*, Dec. 19, 1848 and Aug. 21, 1849; *Kentucky Acts*, 1852, pp. 728-37. Loaded with cotton, the *Monterey* burned in Louisiana in 1849. John R. Smith and J. R. Sloan sold the *Greenwood* in 1849; it exploded its boiler on the Kanawha River in 1850, taking two lives.
14. Annual Report of the Board of Internal Improvement, 1847, *Legislative Documents*, 1848, p. 536.
15. Annual Report of the Board of Internal Improvement, 1847, *Legislative Documents*, 1848, pp. 544-48; Frankfort *Commonwealth*, May 15, 1849.
16. *Kentucky House Journal*, 1846, pp. 103-05; Frankfort *Commonwealth*, June 27, 1848. Metcalfe filled the unexpired term of Senator John J. Crittenden who had resigned.
17. Frankfort *Commonwealth*, Jan. 4, Aug. 30, 1837; June 27, 1838; and June 27, Dec. 26, 1848. The issue of May 16, 1865, prints the obituary for Cates.
18. *Kentucky House Journal*, 1848-1849, pp. 320-24; Frankfort *Commonwealth*, Dec. 26, 1848.
19. *Kentucky House Journal*, 1849-1850, p. 84.
20. Annual Report of the Board of Internal Improvement, 1848, *Legislative Documents*, 1849, p. 499; *Kentucky Senate Journal*, 1848-1849, pp. 209-25. Frankfort *Commonwealth*, Mar. 12, 1850, reports the appointment of Andrew Monroe as replacement for Austin Cox. Cox became Board Secretary again under David R. Haggard and served until 1858, when appointed commissioner to survey the Tennessee and Kentucky boundary.
21. Frankfort *Commonwealth*, May 15, July 10, 1849, and Aug. 27, 1855. A disease afflicting the intestines, causing dehydration and often quick death, cholera was (and is) spread through water supplies contaminated by sewage. The epidemic visited Louisville and Lexington before reaching Frankfort and it may have come to Frankfort through travelers other than the *Sea Gull's* passenger.
22. Annual Report of the Board of Internal Improvement, 1849, *Legislative Documents*, 1850, pp. 518-19.

23. Ibid.

24. Annual Report of the Board of Internal Improvement, 1848, *Legislative Documents, 1849*, p. 499. Board of Internal Improvement Papers, Box 2, Accounts of Auditors Office, Kentucky State Library and Archives, Frankfort, KY, contains cost account for the steam dredge. When it began dredging on Aug. 20, 1849, its crew included Michael Lang, John Hogan, Patrick Flanery, Joseph Hughes, Dennis Hagens, William Keats, James Philbin, and John N. Burns.

25. Annual Report of the Board of Internal Improvement, 1849, *Legislative Documents, 1850*, pp. 518-19.

26. *Kentucky House Journal, 1848-1849*, pp. 190-91; Annual Report of the Board of Internal Improvement, 1848, *Legislative Documents, 1849*, p. 506-08; Annual Report of the Board of Internal Improvement, 1849, *Legislative Documents, 1850*, pp. 518-19.

27. Annual Report of the Board of Internal Improvement, 1849, *Legislative Documents, 1850*, p. 530; *Kentucky House Journal, 1849-1850*, pp. 172, 446-47; *Frankfort Commonwealth*, Mar. 5, Apr. 23, 1850, and May 16, 1865.

28. *Kentucky House Journal, 1850-1851*, p. 680; Annual Report of the Board of Internal Improvement, 1850, *Legislative Documents, 1850-1851*, pp. 1-4.

29. Annual Report of the Board of Internal Improvement, 1850, *Legislative Documents, 1850-1851*, pp. 1-4.

30. Annual Report of the Board of Internal Improvement, 1850, *Legislative Documents, 1850-1851*, pp. 1-4.

31. *Frankfort Commonwealth*, Jan. 9, Jan. 16, 1849, and Feb. 26, Mar. 5, 1850; Bennett H. Young, *History and Texts of the Three Constitutions of Kentucky* (Louisville: Courier-Journal Printing Co., 1890), pp. 56-58.

32. *Frankfort Commonwealth*, June 19, 1849; Apr. 30, 1850; and May 18, 1860. Stealey became wealthy from service in California on a peace mission to hostile Indian tribes; see U. S., Cong., Sen., *Report on the Memorial of George Stealey*, Sen. Rept. No. 274, 35th Cong., 1st Sess., 1858. In 1864 Stealey became Louisville's City Engineer.

33. *Frankfort Commonwealth*, Feb. 14, 1865, prints Stealey's survey report completed in 1858

34. Annual Report of the Board of Internal Improvement, 1850, *Legislative Documents, 1851*, pp. 737-61; *Frankfort Commonwealth*, Sept. 2, 1851.

35. *Frankfort Commonwealth*, Mar. 25, Apr. 22, 1845; Apr. 13, 27, Sept. 7, and Dec. 7, 1847; Sept. 2, 1851; and Jan. 23, 1852; Laura Butler and Randolph N. Smith, *Cumberland County Will Records, 1815-1912* (Burkesville, KY: authors, 1976), pp. 127-28; J. W. Wells, *History of Cumberland County* (Louisville: Standard Printing Co., 1947), pp. 119, 211, 217. Dr. Haggard was the son of Rev. David Rice Haggard who came to Kentucky in 1791 as a Methodist circuit rider and became a founder of the Disciples of Christ or Christian Church. Randolph Smith preserved the Haggard family log cabin in Burkesville.

36. Annual Report of the Board of Internal Improvement, 1850, *Legislative Documents, 1851*, pp. 727-61.

37. Ibid.

38. Annual Report of the Board of Internal Improvement, 1853, *Legislative Documents, 1854*, pp. 2-4.

39. Annual Report of the Board of Internal Improvement, 1853, *Legislative Documents, 1854*, pp. 4-7.

40. *Kentucky House Journal, 1853-1854*, pp. 498-99.

41. Annual Report of the Board of Internal Improvement, 1853, *Legislative Document No. 4, 1854*, pp. 5-6.

42. Ibid.

43. Annual Report of the Board of Internal Improvement, 1853, *Legislative Document No. 4, 1854*, pp. 8-9.
44. *Ibid.*; *Frankfort Commonwealth*, Aug. 3, 1855.
45. Annual Report of the Board of Internal Improvement, 1857, *Legislative Document No. 15, 1858*, p. 4.
46. *Ibid.*; Annual Report of the Board of Internal Improvement, 1859, *Legislative Document No. 5, 1860*, p. 4.
47. *Ibid.*

7. STRUGGLES ON THE KENTUCKY

1. Annual Report of the Board of Internal Improvement, 1857, *Legislative Document No. 15, 1858*, p. 14, quotes Dr. Haggard; *Kentucky House Journal, 1859-1860*, pp. 358-59.
2. *Kentucky House Journal, 1853-1854*, p. 5; Franklin Gorin, *The Times of Long Ago: Barren County, Kentucky* (Louisville: John P. Morton Co., 1929), pp. 48, 58, 73. Dr. Haggard ran for office in 1859 in the Opposition Party, formed by remnants of the Whig Party, and lost reelection to Democrat James P. Bates; see *Frankfort Commonwealth*, May 18, Aug. 5, 1859. E. Merton Coulter, "The Downfall of the Whig Party in Kentucky," *Register of Kentucky Historical Society* 23(May 1925):161-74, traces the Whig party's dissolution during the 1850s.
3. Glen Edward Taul, "Thomas Scudder Page," in Kleber, ed., *Kentucky Encyclopedia*, p. 707. The embezzled funds apparently were taken from general tax revenues rather than project toll revenues.
4. *Kentucky House Journal, Called Session, 1861*, pp. 206-07.
5. *Kentucky Acts, 1864*, pp. 96-97; Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 12, 1866*, p. 4. On December 8, 1861, the legislature abolished the office of President of the Board of Internal Improvement to create a new board and prescribe its duties. James P. Bates returned to Warren County after the war and in 1871 Congress restored his citizenship; see Collins, *History of Kentucky*, I, 213.
6. *Kentucky Senate Journal, 1861-1862*, p. 373-77; Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 12, 1866*, p. 4.
7. Annual Report of the Board of Internal Improvement, 1863, *Legislative Document No. 8, 1864*, pp. 1-8. Histories of steamboats mentioned are printed alphabetically in Frederick Way, Jr., *Way's Packet Directory, 1848-1983* (Athens, OH: Ohio University, 1983).
8. Annual Report of the Board of Internal Improvement, 1863, *Legislative Document No. 8, 1864*, pp. 1-8. Lock keepers during Civil war were: R. B. Gwin at Lock No. 1, William Walston at No. 2, James R. Hardin at No. 3, J. W. Zook at No. 4, and Matthew Skelton at No. 5.
9. *Way's Packet Directory*, pp. 55-56.
10. *ibid.*, pp. 56, 492; *Frankfort Commonwealth*, Nov. 11, Dec. 30, 1863, and Oct. 21, 1865.
11. *Frankfort Commonwealth*, May 20, June 3, 23, 1863; Nicky Hughes, "Fort Boone and the Civil War Defense of Frankfort," *Register of the Kentucky Historical Society* 88(Spring 1990):148-62.
12. Annual Report of the Board of Internal Improvement, 1866, *Legislative Document No. 20, 1867*, p. 22; *Kentucky Acts, 1863*, p. 389; *Kentucky House Journal, 1861-62-63*, p. 1355.
13. Annual Report of the Board of Internal Improvement, 1863, *Legislative Document No. 8, 1864*, pp. 1-8; Special Report of the Board of Internal Improvement, *Legislative Document No. 17, 1865*, pp. 6-7.
14. U.S., Cong., Sen., *Relief of D. R. Haggard*, Sen. Rept. No. 650, 43d Cong., 2d Sess., 1875, pp. 1-2; Special Report of the Board of Internal Improvement, *Legislative Document No. 17, 1865*, p. 9.

15. Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 12*, 1866, p. 4; Special Report of the Board of Internal Improvement, *Legislative Document No. 17*, 1865, pp. 4-5.
16. Special Report of the Board of Internal Improvement, *Legislative Document No. 17*, 1865, pp. 4-5.
17. *Ibid.*, pp. 6-7; Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 32*, 1866, p. 54.
18. Special Report of the Board of Internal Improvement, *Legislative Document No. 17*, 1865, pp. 6-7.
19. *Ibid.*; *Frankfort Commonwealth*, Oct. 21, 1865.
20. Maj. Gen. William T. Sherman to Brig. Gen. Stephen Burbridge, Apr. 23, 1864, U. S. War Department, *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies* (128 vols.; Washington, DC: Government Printing Office, 1880-1901), Series 1, Vol. 32, p. 463.
21. John B. Castleman, *Active Service* (Louisville: Courier-Journal Printing Co., 1917), pp. 172-87; *Frankfort Commonwealth*, Sept. 22, 1865, reported incendiaries burned 200 steamboats during the war, with much loss of property and lives.
22. George D. Mosgrove, *Kentucky Cavaliers in Dixie* (Louisville: Courier-Journal Printing Co., 1895), p. 123.
23. Collins, *History of Kentucky*, I, 139; *Louisville Journal*, Aug. 31, 1864; *Frankfort Commonwealth*, Sept. 1 and 5, 1864, reports Jesse's band destroyed Lock No. 1, causing \$5,000 damages, and the editor remarked: "Many men have pulled hemp for less crimes than they are guilty of." Jesse survived the war and received congressional pardon in 1871.
24. *Frankfort Commonwealth*, Feb. 14, 1865.
25. *Frankfort Commonwealth*, Feb. 24, 28, and Mar. 3, 1865; Kentucky River Navigation Company, *Charter of the Kentucky River Navigation Company* (Frankfort: Osborne and Co., 1865), *passim*.
26. *Louisville Journal*, Oct. 21, 1865; Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 32*, 1866, p. 8.
27. Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 32*, 1866, pp. 8, 11.
28. Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 12*, 1866, pp. 4-5, 52.
29. *Ibid.*, pp. 7-8, 52.
30. "Memoir of David Yancy Little," *Kentucky Explorer* 12 (June 1997):91; Annual Report of the Board of Internal Improvement, 1867, *Legislative Document No. 20*, 1868, p. 10; Frank Russell to William Chandler, Aug. 10, 1939, NA1153, Record Group 77, Records of the Corps of Engineers, National Archives, Southeast Region, East Point, GA (NA location cited hereafter as East Point, GA), states Russell of Louisville was a crewman on the last ironboat in 1886 transporting 250 tons of pig iron from Miller's Creek to Frankfort.
31. Annual Report of the Board of Internal Improvement, 1867, *Legislative Document No. 20*, 1868, p. 9.
32. *Ibid.*, pp. 5, 10-12; *Kentucky House Journal*, 1867, pp. 629-34.
33. Reports of the Auditing and Settlement of the Accounts of the Board of Internal Improvement, *Legislative Document No. 7*, 1867, pp. 5-34.
34. Annual Report of the Board of Internal Improvement, 1867, *Legislative Document No. 20*, 1868, pp. 25-27.
35. *Ibid.*

36. *Kentucky House Journal*, 1867-1868, pp. 548-52.
37. Annual Report of the Board of Internal Improvement, *Legislative Document No. 20*, 1868, pp. 7.
38. *Ibid.*; Annual Report of the Board of Internal Improvement, 1865, *Legislative Document No. 12*, 1866, pp. 11-13.
39. Annual Report of the Board of Internal Improvement, 1867, *Legislative Document No. 20*, 1868, p. 21; Crocker, *Green River*, pp. 30-31; *Kentucky Senate Journal*, 1867-1868, p. 523; *Kentucky Acts*, 1869, pp. 3-5; *Frankfort Commonwealth*, Jan. 29, Feb. 12, May 7, Sept. 3, 1869.
40. *Kentucky House Journal*, 1867, p. 47; *Kentucky Acts*, 1869-70, I, 82; Collins, *History of Kentucky*, I, 195, 199, 233; *Frankfort Commonwealth*, May 6, 1870. Moreau Brown manufactured rope and bagging at Nicholasville, shipping it south by steamboats; see Bennett H. Young, *A History of Jessamine County, Kentucky* (Louisville: Courier-Journal Printing Co., 1898), pp. 161, 193-94.
41. *Kentucky Senate Journal*, 1873, pp. 830-37; *Frankfort Commonwealth*, May 6, 1870, lists, in addition to Brown and Swigert, company directors G. S. Shanklin of Jessamine, Thomas Porter of Woodford, C. J. Spillman of Garrard, J. R. Bryant of Mercer, Squire Turner of Madison, Thomas Bradley and John Mason Brown of Fayette, Isaac Smith of Clark, and W. B. Belknap and James Batchelor of Louisville.
42. *Kentucky Senate Journal*, 1873, pp. 830-37.
43. *ibid.*

8. THE DISASTROUS DEBUT

1. George Baber, "J. Stoddard Johnston," *Register of Kentucky Historical Society* 14 (Jan. 1916):9-13; J. Stoddard Johnston, "The Kentucky River in Its Relation to the Development of the Eastern Kentucky Coal Field," Part II of J. Stoddard Johnson and Basil W. Duke, *Transportation Systems together with a Review of Transportation Problems and Opportunities to be Solved* (Frankfort, KY: Capital Printing Co., 1887), pp. 51-65, quotes Colonel Johnston.
2. Baber, "J. Stoddard Johnston," pp. 9-13. *Kentucky Yeoman* was distinguished by pithy encapsulation of local and state news and humorous campaigns against hogs roaming free in Frankfort streets and similar social ills. Because of his military service, its editor was universally known as "Colonel Johnston."
3. Baber, "J. Stoddard Johnston," pp. 9-13; Hambleton Tapp and James C. Klotter, *Kentucky: Decades of Discord, 1865-1900* (Frankfort: Kentucky Historical Society, 1977), pp. 33, 132.
4. Examples of *Yeoman* reporting are: Aug. 28, 1877 (catfish in Big Eddy), July 24 and Sept. 25, 1877 (boat race), July 23, 1877 (green slime), Feb. 12, 1878 (flood washed out Dam No. 5), Mar. 19 and May 21, 1878 (coal barges and log rafts), Apr. 16, 1878 (steamboat), June 4, 1878 (fish stocking).
5. Verhoeff, *Kentucky River Navigation*, pp. 104-11; Johnson, *The Falls City Engineers, 1970-1983*, pp. 242-50; Coleman, *Steamboats on the Kentucky River*, pp. 31-36; Gilliam, "Robert Perkins Letcher," pp. 11-17; J. Stoddard Johnston, "The Kentucky River in Relation to the Development of the Eastern Kentucky Coal Field," in *Seventh Annual Report from the Bureau of Agriculture* (Frankfort, Legislative Doc. No. 12, 1887), Part III, p. 56; *Yeoman*, Feb. 12, 1878.
6. Nathaniel S. Shaler, *The Autobiography of Nathaniel Southgate Shaler* (New York: Houghton and Mifflin Co., 1909), p. 292; Nathaniel S. Shaler and John R. Proctor, "On the Importance of Improvement in the Navigation of the Kentucky River to the Mining and Manufacturing Interests of the Commonwealth," *Bulletin of the Kentucky Geological Survey* (No. 1, 1877):22-45; Nathaniel S. Shaler, "On the Improvement of the Rivers of Kentucky," *Bulletin of the Kentucky Geological Survey* (No. 1, 1879):13-21.

7. Shaler and Proctor, "On the Importance of Improvement in the Navigation of the Kentucky River," p. 37; Russell W. McRery, "Kentucky River Mills 1886," (Manuscript No. 336, Kentucky Historical Society Library, Frankfort, KY); *Yeoman*, July 2, 1878; Frankfort *Roundabout*, Feb. 15, 1890; Johnson, *The History of Franklin County, Kentucky*, pp. 29-30.
8. Johnson, *The History of Franklin County*, pp. 166, 169, 195; Judge Lysander Hord published his *Yeoman* serial as *Letters in Relation to the Improvement of the Kentucky and other Rivers, and the Kentucky Penitentiary* (Frankfort: A.G. and J. A. Hodges, 1877); accounts of rallies and legislative action anent Kentucky River are *Yeoman*, Jan. 27, Feb. 12, 1876; Jan. 20, Feb. 13, Feb. 24, Aug. 7, Aug. 14, Dec. 18, Dec. 25, 1877; and Apr. 16, Apr. 30, June 11, 1878.
9. Elmer G. Sulzer, "Kentucky's Abandoned Railroads: Two Southern Segments," *Kentucky Engineer* 9 (Aug. 1947):15-21, 42-46; *Yeoman*, Oct. 2, Nov. 6, Nov. 22, 1877; Apr. 16, Apr. 30, 1878; and Dec. 7, 1880.
10. Governor James B. McCreary, Executive Journal, 1877-1879, (James B. McCreary Papers, Kentucky State Library and Archives, Frankfort, KY), pp. 132-34; *Yeoman*, Jan. 8, 1878; Tapp and Klotter, *Kentucky: Decades of Discord, 1865-1900*, pp. 157-58.
11. Tapp and Klotter, *Kentucky: Decades of Discord, 1865-1900*, p. 156; *Yeoman*, Apr. 16, Apr. 23, Apr. 30, May 28, 1878. An editorial in *Engineering News* 5 (Mar. 7, 1878):74, notes Kentucky River project debates in the General Assembly indicated "the solons seem to be divided sectionally; it is quite impossible to include every member's back yard in the project."
12. *Yeoman*, Apr. 16, Apr. 23, Apr. 30, May 28, 1878.
13. *Yeoman*, June 25, 1878.
14. Hord, *Letters in Relation to the Improvement of the Kentucky and other Rivers, and the Kentucky Penitentiary*, pp. 1, 7, 60-61, 65; Bill L. Weaver, "President Hayes' Visit to Kentucky, 1877," *Filson Club History Quarterly* 46 (Jan. 1972):37-48; Lysander Hord to John M. Harlan, Apr. 26, 1877, File 779, Entry 71, NARG77; Citizens of Frankfort, KY, to Pres. R. B. Hayes, Apr. 9, 1877, File 704, *ibid.*; Brig. Gen. A. A. Humphreys to Secretary of War, Nov. 2, 1877, Vol. 2, 297, Entry 66, NARG77; Maj. John G. Parke to Cong. Thomas Turner, Nov. 15, 1877, Vol. 2, 332, *ibid.*; editorial, *Engineering News* 5 (Apr. 25, 1878):129; U.S., Congress, House, *Congressional Record*, 45th Cong., 2d Sess., 1878, pp. 1327, 2010, 2628.
15. *Yeoman*, July 23 and 30, 1878; Maj. George Elliot to Col. William Merrill, Aug. 17, 1878, Vol. 2, 266, Entry 66, NARG77; Maj. John G. Parke to Col. William Merrill, Vol. 2, 605, *ibid.*
16. U. S. War Department, *Annual Report of the Chief of Engineers for 1879* (Washington, DC: Government Printing Office, 1880), pp. 1398-1421 (serial set cited hereafter as *ARCE* followed by fiscal year of the report). Fitzhugh's assistant surveyors were M. H. Jouett, M. E. S. Posey, B. R. Turner, F. M. Pryor, J. T. Timberlake, and Samuel Todd.
17. *Yeoman*, Jan. 21, Feb. 25, Mar. 6, 1879; Brig. Gen. A. A. Humphreys to George W. McCrary, Jan. 20, 1879, Vol. 1, 49, Entry 66, NARG77; Maj. John G. Parke to George W. McCrary, Dec. 13, 1879, Vol. 3, 1253, *ibid.*; *Kentucky House Journal*, 1879-1880, pp. 734-35, 791-92, 1005-06.
18. Col. William E. Merrill to Brig. Gen. A. A. Humphreys, Apr. 7, 1879, File 906, Letters Received, 1879, NARG77; Capt. James Cuyler to Brig. Gen. Horatio G. Wright, May 4, 1880, File 1213, Letters Received, 1880, NARG77; Maj. James Cuyler, "Statement to Board of Engineer Officers Constituted by S. O. No. 115," Oct. 25, 1882, File 629, NARG77; *ARCE*, 1881, pp. 1971-79; "James W. Cuyler," *Engineering News* 10 (Apr. 21, 1883):189.
19. apt. James Cuyler to Brig. Gen. Horatio G. Wright, May 4, 1880, File 1213, Letters Received, 1880, NARG77.
20. *ibid.*; Cuyler, "Statement to Board of Engineer Officers Constituted by S. O. No. 115," Oct. 25, 1882, File 629, NARG77; *ARCE*, 1881, pp. 1971-79; Frankfort, KY, *Yeoman*, Nov. 28, 1882. Construction supervisors at Dams 2 through 4 were David L. Sublett, Hugh R. Ayres, and J. W. Walker.
21. *ARCE*, 1880, pp. 1825-37; *ARCE*, 1881, pp. 1971-79.

22. Frankfort, KY, *Yeoman*, Nov. 3 and 15, 1881; *ARCE*, 1881, pp. 1971-79; *ARCE*, 1882, pp. 1945-51; *ARCE*, 1883, p. 1562; Capt. James Cuyler to Brig. Gen. Horatio G. Wright, May 9, 1882, File 976, Letters Received, 1882, NARG77; Maj. James Cuyler, "Statement to Board of Engineer Officers Constituted by S. O. No. 115," Oct. 25, 1882, File 629, NARG77.
23. Frankfort, KY, *Yeoman*, Nov. 3 and 15, 1881; *ARCE*, 1882, pp. 1945-51.
24. *ARCE*, 1883, p. 1562, prints maps of Dam No. 1 breach and repairs.
25. *ARCE*, 1882, p. 1948; *ARCE*, 1883, p. 1562.
26. *ARCE*, 1882, p. 1949. Capt. Henry Brashear of Madison, IN, built the *City of Frankfort* in 1881; it was the last steamboat commanded by Capt. Samuel Sanders in the Louisville to Madison and Frankfort trade. *Yeoman* in July 1882 reported Captain Sanders landed this boat at Frankfort with the Madison, IN, brass band aboard, drawing 1,000 spectators to the river. Paired with it in the Madison to Frankfort trade was the *Hornet*, which also ran excursions from Frankfort to Tyrone.
27. Brig. Gen. Horatio G. Wright to Sec. of War Robert Lincoln, Apr. 20, 1882, Vol. 1, p. 513, Letters Sent, 1882, Entry 66, NARG77; Brig. Gen. Horatio G. Wright to Capt. James Cuyler, May 13, 1882, Vol. 1, p. 606, *ibid.*; Maj. Gen. John Parke to Capt. James Cuyler, May 20, 1882, Vol. 1, p. 643, *ibid.*; Cong. John D. White to Sec. of War Robert Lincoln, Apr. 29, 1882, File 976, Letters Received, 1882, NARG77; William H. Murray to Sen. John S. Williams, Sept. 4, 1882, *ibid.*; *Yeoman*, Aug. 31, 1882.
28. William H. Murray to Sec. of War Robert Lincoln, Aug. 19, 1882, Letters Received, 1882, NARG77; William H. Murray to Sen. John S. Williams, Sept. 4, 1882, *ibid.* Capt. James Cuyler to Brig. Gen. Horatio G. Wright, Oct. 27, 1882, *ibid.*, reported he rejected Murray's earlier application for employment; Maj. Gen. John Parke to Sec. of War Robert Lincoln, Apr. 22, 1881, Letters Sent, 1881, Entry 66, NARG77, encloses letter from Frankfort Postmaster J. G. Hatchitt complaining that former Confederates such as Capt. Robert Fitzhugh were employed on the Kentucky River instead of Union Army veterans.
29. "Report of the Board of Engineer Officers constituted by Par. 1, Special Orders No. 115," Oct. 25, 1882, File 629, NARG77.
30. *Ibid.*; James W. Cuyler, 3657ACP1877, Personnel files, Old Military Records Branch, National Archives, Washington, DC; "James W. Cuyler," *Engineering News* 10 (Apr. 21, 1883):189. Cuyler was taking medications including opiates at his death.
31. *ARCE*, 1883, pp. 1560-64; *ARCE*, 1884, pp. 1728-49. See Robert H. Fitzhugh, *Among the Crags, or The Voice of the Rocks* (Lexington, 1895); R. E. Lee (Lexington, 1910), and *Life to Life* (Lexington, 1910) in University of Kentucky Library, Lexington, KY.
32. J. Stoddard Johnson and Basil W. Duke, *Transportation Systems together with a Review of Transportation Problems and Opportunities to be Solved*, Part II, pp. 51-65.
33. *Ibid.*
34. *ARCE*, 1883, pp. 1560-64; *ARCE*, 1884, pp. 1728-49.
35. Nathaniel S. Shaler, "On the Improvement of the Rivers of Kentucky," *Bulletin of the Kentucky Geological Survey* 1(1879):13-21; Thomas D. Clark, "Kentucky Logmen," *Journal of Forest History* 25(July 1981):144-56; Leland R. Johnson, *The Davis Island Lock and Dam, 1870-1922* (Pittsburgh, PA: U.S. Army Engineer District, 1985), pp. 34-41; Brig. Gen. Horatio G. Wright to Cong. John D. White, May 6, 1882, Vol. 1, p. 582, Letters Sent, 1882, Entry 66, NARG77; Fred E. Coy, Jr., Tom Fuller, Larry G. Meadows, and Don Fig, "Splash Dam Construction in Eastern Kentucky's Red River Drainage Area," *Forest and Conservation History* 36(Oct. 1992):179-84.
36. Verhoeff, *Kentucky River Navigation*, pp. 167-82; *Yeoman*, Jan. 18, 1879, and Nov. 13, 1880.
37. Capt. James Cuyler to Brig. Gen. Horatio G. Wright, May 3, 1882, File 1305, Letters Received, 1882, NARG77; *Louisville Courier-Journal*, May 16, 1882.

38. Brig. Gen. Horatio G. Wright to Cong. John D. White, May 6, 1882, Vol. 1, p. 582, Letters Sent, 1882, Entry 66, NARG77; Maj. Gen. John Parke to Capt. James Cuyler, Aug. 8, 1882, Letters Sent, 1882, p. 951, NARG77; G. W. Daniel to Capt. James W. Cuyler, Apr. 23, 1882, File 1305, Letters Received, 1882, NARG77.
39. *ARCE*, 1883, pp. 1560-61.
40. *ARCE*, 1883, p. 1564; *ARCE*, 1884, pp. 1729-31; Johnson, *Davis Island Lock and Dam*, pp. 34-41.
41. G. W. Daniel to Capt. James W. Cuyler, Apr. 23, 1882, File 1305, Letters Received, 1882, NARG77; *ARCE*, 1884, p. 1723-46.
42. *ARCE*, 1884, pp. 1723-46; Edward Wegmann, *The Design and Construction of Dams* (New York: John Wiley & Sons, 1922), pp. 34-45.
43. Wegmann, *Design and Construction of Dams*, pp. 34-45; *ARCE*, 1884, pp. 1731-46.
44. *ARCE*, 1884, pp. 1731-46; see also "Kentucky River," *Engineering News* 14(Jan. 31, 1885):80.
45. Capt. H. M. Adams to Capt. James C. Post, June 10, 1885, Vol. 1, p. 583, Letters Received, 1885, Entry 66, NARG77; *ARCE*, 1885, p. 1872; *ARCE*, 1886, pp. 1604-09; *ARCE*, 1887, p. 1893.
46. *A Prospectus of the Three Forks Investment Company: Its Beattyville Town Site* (Louisville: Courier-Journal Printing, 1889), pp. 1-15 (copy at Kentucky Historical Society Library, Frankfort, KY).
47. *ARCE*, 1887, pp. 1872-1880.
48. *Ibid.*
49. *Ibid.*
50. *Ibid.*, pp. 1880-85.
51. *ARCE*, 1888, p. 1772-74; *ARCE*, 1889, pp. 1973-74; *ARCE*, 1890, pp. 2264-66; Edward B. Clark, William L. Sibert, *The Army Engineer* (Philadelphia: Dorrance & Co., 1938), indicates Sibert was better known for services on the Green River and Panama Canal than for his Kentucky River work. A sternwheeler operating from 1883 to 1891, the *Ingomar* was owned by J. N. and J. E. Abrahams of Frankfort and piloted by Squire J. Preston of Salvisa. An 1889 cargo manifest listed 2100 bushels grain, 215 barrels whiskey, 4 tons manufactured iron, 20 passengers, and 3 tons merchandise.
52. *ARCE*, 1890, pp. 2262-63; *ARCE*, 1891, p. 2449; Sulzer, "Kentucky's Abandoned Railroads: The Riney-B," pp. 14-19, 28-30.
53. *ARCE*, 1890, p. 2262-63; *ARCE*, 1891, pp. 2454-55; *ARCE*, 1897, p. 2519.
54. *ARCE*, 1893, p. 2618. Sulzer, "Kentucky's Abandoned Railroads: The Riney-B," pp. 14-19, 28-30.
55. Jennie C. Morton, "Governor James B. McCreary," *Register of Kentucky Historical Society* 13(Sept. 1915):11-12; James B. McCreary to Brig. Gen. Alexander MacKenzie, Jan. 27, 1905, File 7759, General Correspondence, 1894-1923, NARG77; Brig. Gen. Alexander MacKenzie to James B. McCreary, May 4, 1906, *ibid.* Publications mentioned are Robert Fitzhugh, *Among the Craggs, or the Voice of the Rocks* (1895), and R. E. Lee (1910); Shaler, *Kentucky: A Pioneer Commonwealth* (1884); Johnston, *Memorial History of Louisville* (1896), *Confederate History of Kentucky* (1898), and *First Explorations of Kentucky* (1898).

9. THE TIMBERCRIB PROJECT

1. David Sublett, Assistant Engineer at Frankfort, quoted from *ARCE*, 1886, p. 1614; Benjamin F. Thomas and D. A. Watt, *The Improvement of Rivers* (New York: John Wiley & Sons, 1913), were authors of this waterways engineering text with personal experience on the Kentucky River; Thomas had charge of the Kentucky River project in 1913-1914, and Watt was related to John M. G. Watt, the resident engineer at Locks and Dams Nos. 7 and 8.

2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid.
6. Ibid., p. 511; see also John M. G. Watt, "Improvement of the Black Warrior," *Transactions of the American Society of Civil Engineers* (New York, 1902), pp. 283-84.
7. ARCE, 1885, p. 1875-77; ARCE, 1886, p. 1616. Hoag built timbercrib dikes on the Ohio River at Wheeling, WV, and Grand Chain, IL, for the Corps of Engineers.
8. ARCE, 1885, pp. 1878-83; ARCE, 1886, p. 1614.
9. Ibid.; ARCE, 1886, p. 1614; ARCE, 1890, p. 2272.
10. ARCE, 1887, pp. 1877-80.
11. Ibid.
12. ARCE, 1887, pp. 1873-75; ARCE, 1888, pp. 1770-72; ARCE, 1892, p. 2083.
13. ARCE, 1892, p. 2083-84; Maj. D. W. Lockwood to Chief of Engineers, Nov. 15, 1888, File 4720, Letters Received, 1888-89, NARG77. Kentucky River craftsmen also worked on the Kanawha, Green, Big Sandy, and Cumberland rivers, moving as contractor employees or individually to find new work.
14. Ibid.
15. Ibid.; Thomas and Watt, *Improvement of Rivers*, pp. 337-48.
16. Thomas and Watt, *Improvement of Rivers*, pp. 337-48; Lt. William W. Harts to Capt. James G. Warren, Jan. 31, 1896, File 24511, General Correspondence, 1894-1923, NARG77.
17. ARCE, 1896, pp. 1980-81; Lt. Col. Amos Stickney to Brig. Gen. Thomas L. Casey, Mar. 8, 1894, File 4774, General Correspondence, 1894-1923, NARG77.
18. ARCE, 1896, pp. 2516-19; ARCE, 1898, pp. 2017-19; Watt, "Improvement of the Black Warrior," pp. 283-84; Leland R. Johnson, *Engineers on the Twin Rivers: A History of the Nashville District, Corps of Engineers, United States Army* (Nashville: U.S. Army Engineer District, 1978), pp. 155-57, 175-76, provides biographical sketch and portrait of William W. Harts.
19. ARCE, 1896, pp. 2526-19; ARCE, 1898, pp. 2017-19; Thomas and Watt, *Improvement of Rivers*, p. 536.
20. ARCE, 1899, pp. 2526-27, 2521-22. Biographical notes on John Marshall Gilkison Watt are in *Engineering News* 60(Dec. 31, 1908):756, and 65(Mar. 9, 1911).
21. ARCE, 1900, pp. 3367-69.
22. Ibid.
23. ARCE, 1888, p. 1777.
24. ARCE, 1885, pp. 1869-71; Lt. Col. W. P. Stokey to Chief of Engineers, Mar. 8, 1922, File 92282, General Correspondence, 1894-1923, NARG77; Coleman, "Kentucky River Steamboats," p. 321.
25. Maj. D. W. Lockwood to Brig. Gen. William P. Craighill, July 10, 1895, File 6884, General Correspondence, 1894-1923, NARG77; ARCE, 1896, p. 2297; ARCE, 1900, p. 3366.
26. John A. Walters family, interviewed by Bob Gates, Kentucky River Folklife Festival, Fort Boonesborough State Park, June 20, 1997; Maj. E. H. Ruffner to Adj. Gen. U. S. Army, Aug. 29, 1901, File 40537, General Correspondence, 1894-1923, NARG77.
27. Thomas and Watt, *Improvement of Rivers*, p. 448.
28. ARCE, 1886, pp. 1611-15; ARCE, 1906, pp. 1663-64.

29. *Kentucky House Journal*, 1877-1878, pp. 141-42; *Yeoman*, Feb. 22, 1879; Kentucky, Fish Commission, *Second Annual Report of the Fish Commission* (Frankfort: E. H. Porter, 1879), pp. 1-18.
30. Benjamin F. Thomas to Lt. Col. H. Jervey, Sept. 5, 1914, and endorsement by Jervey of Sept. 8, 1914, File 6884, General Correspondence, 1894-1923, NARG77.
31. ARCE, 1885, p. 1878.
32. *Way's Packet Directory*, pp. 362, 429.
33. ARCE, 1889, p. 373-76; ARCE, 1890, pp. 2269, 2458; ARCE, 1894, p. 1986; Johnson, *History of Franklin County*, p. 218.
34. ARCE, 1896, p. 2296; ARCE, 1898, p. 2031; John W. Langley to Chief of Engineers, Mar. 21, 1909, File 71117, General Correspondence, 1894-1923, NARG77; Benjamin F. Thomas to Lt. Col. J. G. Warren, Apr. 2, 1909, File 71117, *ibid.*; Albert E. Cowdrey, "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act," *Pacific Historical Review* 44(Aug. 1975):331-49.
35. Thomas D. Clark, "Kentucky Logmen," *Journal of Forest History* 25(July 1981):144-57; J. H. Hart, "Logging on the Kentucky River," *Kentucky Explorer* 3(Oct. 1988):5-10.
36. J. B. Thomas to W. M. Beckner, Aug. 9, 1894, File 6890, General Correspondence, 1894-1923, NARG77.
37. See correspondence, File 6890, *ibid.*
38. ARCE, 1896, pp. 2288-99; ARCE, 1898, pp. 2015-16; William H. McAlpine to Capt. J. C. Oakes, Apr. 11, 1910, File 7759, General Correspondence, 1894-1923, NARG77.
39. ARCE, 1898, pp. 2015-16; Frank Russell to William Chandler, Aug. 10, 1939, NA1153, NARG77, East Point, GA.
40. Maj. James F. Gregory to Brig. Gen. William P. Craighill, Aug. 24, 1896, File 7759, General Correspondence, 1894-1923, NARG77, encloses Harts' analysis of the Kentucky River project.
41. *Ibid.*
42. *Ibid.*
43. *Ibid.*; ARCE, 1897, pp. 374-75; ARCE, 1898, pp. 2015-16; ARCE, 1900, p. 3364.
44. ARCE, 1898, pp. 2012-16; ARCE, 1899, pp. 2513-14.
45. U.S., Cong., House, *Deterioration of River and Harbor Works*, H. Doc. No. 230, 56th Cong., 1st Sess., 1900, pp. 11-12; Capt. Harry F. Hodges to Brig. Gen. John D. Wilson, July 22, 1899, File 7024, General Correspondence, 1894-1923, NARG77.

10. THE CONCRETE RESULTS

1. Leland R. Johnson, *The Ohio River Division, U. S. Army Corps of Engineers: The History of a Central Command* (Cincinnati: U.S. Army Engineer Division, 1992), pp. 48-51; Lt. Col. Thomas H. Handbury to Brig. Gen. George Gillespie, Oct. 2, 1901 and Nov. 5, 1901, File 40846, General Correspondence, 1894-1923, NARG77, quotes Handbury.
2. Lt. Col. Thomas H. Handbury to Brig. Gen. George Gillespie, Nov. 30, 1901, File 40934, General Correspondence, 1894-1923, NARG77.
3. *Ibid.*
4. ARCE, 1901, p. 2713; Ernest H. Ruffner to Brig. Gen. William M. Black, July 18, 1917, File 104843, General Correspondence, 1894-1923, NARG77; Col. Lansing H. Beach to Brig. Gen. William M. Black, Aug. 3, 1917, *ibid.*; see also Ernest H. Ruffner, *The Practice of the Improvement of the Non-Tidal Rivers of the United States* (New York: J. Wiley & Sons, 1885).

5. Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Mar. 12, 1903, File 45998, General Correspondence, 1894-1923, NARG77; Leland R. Johnson, *Addison N. Scott: Kanawha River Canalization, 1875-1901* (Huntington, WV: U.S. Army Engineer District, 1979), pp. 10-11.
6. Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Mar. 10, 1902, File 27028, General Correspondence, 1894-1923, NARG77; Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Mar. 12, 1903, File 45998, General Correspondence, 1894-1923, NARG77; notes in *Engineering News* 60(Dec. 31, 1908):756 and 65(Mar. 9, 1911):307, mention John M. G. Watt's service at Hales Bar and Gatun locks.
7. Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Mar. 12, 1903, File 45998, General Correspondence, 1894-1923, NARG77; Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, July 12, 1905, File 56153, *ibid.*; Charles F. Walthers to Brig. Gen. George Gillespie, May 28, 1902, File 24521, *ibid.*; *ARCE*, 1903, pp. 1751-52.
8. Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Mar. 12, 1903, File 45998, General Correspondence, 1894-1923, NARG77; *ARCE*, 1903, pp. 1753-54.
9. Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Feb. 3, 1903, File 45998, General Correspondence, 1894-1923, NARG77; James Bransom to Maj. Ernest H. Ruffner, Feb. 7, 1903, *ibid.*; Maj. Ernest H. Ruffner to Brig. Gen. George Gillespie, Apr. 5, 1902, *ibid.*, lists Kentucky River Lockmasters: No. 1, Lon Dugan; No. 2, Joel Payne; No. 3, Thomas Eddins; No. 4, James Bransom; No. 5, H. A. Cline; No. 6, F. H. Duvall; No. 7, Charles L. McKee; No. 8, J. B. Smith.
10. Brig. Gen. George Gillespie to Maj. Ernest H. Ruffner, Mar. 11, 1903, File 45998, General Correspondence, 1894-1923, NARG77.
11. Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, July 12, 1905, File 56153, General Correspondence, 1894-1923, NARG77; *ARCE*, 1903, pp. 1759-61; Thomas and Watt, *Improvement of Rivers*, pp. 506-12; William H. McAlpine, "Elements Affecting Lock Construction on Canalized Rivers Having Fixed Dams," *Professional Memoirs, Corps of Engineers* 3(Oct. 1911):587-90.
12. John M. G. Watt, "Improvement of Black Warrior River," p. 283; Capt. Harry Hodges to Brig. Gen. John M. Wilson, Mar. 4, 1901, File 7759, NARG77; Thomas and Watt, *Improvement of Rivers*, pp. 432-43.
13. Joseph B. Bishop and Farnham Bishop, *Goethals, Genius of the Panama Canal* (New York: Harper & Bros., 1930), pp. 202-03; Duncan Hodges, "Harry Foote Hodges, M.ASCE," *Transactions of the American Society of Civil Engineers* 94(1930):1528-31; *ARCE*, 1900, p. 3369; Thomas and Watt, *Improvement of Rivers*, p. 489-96; William H. McAlpine, "Elements Affecting Lock Construction on Canalized Rivers Having Fixed Dams," *Professional Memoirs, Corps of Engineers* 3(Oct. 1911):587-90.
14. *Louisville Journal*, Apr. 26, 1904; Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, Apr. 29, 1904, File 42086, General Correspondence, 1894-1923, NARG77.
15. *ARCE*, 1901, pp. 2744-46; *ARCE*, 1902, p. 1953; *ARCE*, 1903, pp. 1748-50; *ARCE*, 1904, p. 2644.
16. Thomas and Watt, *Improvement of Rivers*, pp. 348-52, 439-45; *ARCE*, 1901, pp. 2744-46; *ARCE*, 1904, p. 2644.
17. *ARCE*, 1902, p. 1953; *ARCE*, 1903, p. 1748; *ARCE*, 1904, p. 2644; *Engineering News* 55(Mar. 15, 1906):308, prints obituary of M. P. Mason of Frankfort.
18. *Louisville Courier-Journal*, Feb. 14, 1905; *ARCE*, 1905, pp. 1913-20.
19. Thomas and Watt, *Improvement of Rivers*, p. 669; see discussion of 1881 flanking in previous chapter, "Disasterous Debut."
20. *Louisville Evening Post*, Mar. 14, 1905; *ARCE*, 1905, pp. 1913-20; Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, Mar. 1, 1905, File 7759, General Correspondence, 1894-1923, NARG77.

21. Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, Mar. 14, 1905, File 7759, General Correspondence, 1894-1923, NARG77.
22. Col. G. J. Lydecker, Maj. James G. Warren, and Maj. William L. Sibert to Brig. Gen. A. Mackenzie, Apr. 28, 1905, File 7759, General Correspondence, 1894-1923, NARG77; Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, May 1, 1905, *ibid.*
23. Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, May 1, 1905, *ibid.*
24. Col. Ernest H. Ruffner to Brig. Gen. William M. Black, July 18, 1917, File 104843, *ibid.*; Col. Lansing H. Beach to Brig. Gen. William M. Black, Aug. 3, 1917, *ibid.*
25. R. E. Thompson to Cong. John W. Langley, Feb. 12, 1909, File 7759, General Correspondence, 1894-1923, NARG77; William H. McAlpine to Lt. Col. James G. Warren, Feb. 16, 1909, *ibid.*; Kentucky River Poplar Company to Lt. Col. James G. Warren, Feb. 9, 1909, *ibid.*
26. William H. McAlpine to Lt. Col. James G. Warren, Feb. 16, 1909, *ibid.*
27. Lt. Col. James G. Warren to Brig. Gen. A. Mackenzie, Aug. 27, 1908, File 7759, *ibid.*; William H. McAlpine to Lt. Col. James G. Warren, Dec. 5, 1908, Box NA1133, NARG77, East Point, GA.
28. William H. McAlpine to Lt. Col. James G. Warren, Dec. 5, 1908, *ibid.*
29. William H. McAlpine to Lt. Col. James G. Warren, July 22, 1909, *ibid.*
30. *ARCE*, 1906, p. 1655; *ARCE*, 1907, p. 1786. Lock No. 9 reopened on Nov. 23 and No. 10 on Dec. 22, 1906.
31. Lt. Col. Ernest H. Ruffner to Brig. Gen. A. Mackenzie, Mar. 14, 1905, File 7759, General Correspondence, 1894-1923, NARG77; Brig. Gen. A. Mackenzie to Sen. James B. McCreary, Feb. 6, 1906, *ibid.*
32. *ARCE*, 1904, pp. 2644-45; *ARCE*, 1905, p. 1914-15; *ARCE*, 1906, p. 1652; *ARCE*, 1910, p. 1999; Lt. Col. James G. Warren to Brig. Gen. A. Mackenzie, File 7759, General Correspondence, 1894-1923, NARG77.
33. Thomas and Watt, *Improvement of Rivers*, pp. 521-23; William M. Hall and H. C. Corns, "Benjamin Franklin Thomas, M.ASCE," *Transactions of the American Society of Civil Engineers* 87(1924):1435-36.
34. Lewis M. Adams, "An A-Frame Movable Top to Provide Increased Depths above Fixed Dams," *Professional Memoirs, Corps of Engineers* 3(Apr. 1911):315-35, prints discussions of Poiree needle and A-Frame crests by Thomas and McAlpine.
35. Thomas and Watt, *Improvement of Rivers*, p. 523.
36. *Ibid.*; *ARCE*, 1907, pp. 1781-86; Adams, "An A-Frame Movable Top to Provide Increased Depths above Fixed Dams," pp. 315-35. Drift damaged Dam No. 11's movable crest again in 1914, and in 1919 its movable crest was replaced with a fixed concrete crest.
37. Adams, "An A-Frame Movable Top to Provide Increased Depths above Fixed Dams," pp. 315-35; Lucien S. Johnson to District Engineer, Oct. 4, 1922, File 97513, General Correspondence, 1894-1923, NARG77.
38. *ARCE*, 1907, p. 1782; *ARCE*, 1908, p. 1851; *ARCE*, 1910, pp. 1992-1996. This dam had a movable Poiree needle crest design initially, replaced in 1920 with a four-foot concrete cap and movable A-frame crest; in 1935 the A-frame crest was removed and later replaced with a fixed crest.
39. Maj. John C. Oakes to Chief of Engineers, Aug. 10, 1910, File 6884, General Correspondence, 1894-1923, NARG77.

11. THE FAMOUS PORKBARREL

1. Frankfort *State Journal*, Jan. 21, 1917, is quoted at the chapter head. Alfred J. Henry, *The Flood of 1913 in the Rivers of the Ohio and Lower Mississippi Valley* (Washington, DC: US Department of Agriculture Bulletin Z, 1913), reviews flood conditions; Brig. Gen. William H. Bixby to Army

- Chief of Staff, Apr. 11, 1913, File 88925, General Correspondence, 1894-1923, NARG77; *ARCE*, 1913, p. 2675; U.S., Cong., House, *Report of the Ohio River Flood Board*, H. Doc. No. 246, 63d Cong., 1st Sess., 1913.
2. Maj. Lewis H. Rand to Chief of Engineers, July 31, 1913, File 78929, General Correspondence, 1894-1923, NARG77.
3. *Ibid.*
4. *ARCE*, 1910, p. 1992; *ARCE*, 1911, p. 2194; *ARCE*, 1913, p. 2194.
5. *ARCE*, 1914, p. 2819; W. G. Peterkin to Chief of Engineers, June 26, 1913, File 87154, General Correspondence, 1894-1923, NARG77.
6. W. G. Peterkin to Chief of Engineers, June 26, 1913, File 87154, General Correspondence, 1894-1923, NARG77; *Beattyville Enterprise*, Aug. 27, 1970, reprints news of June 2, 1911.
7. W. G. Peterkin to Chief of Engineers, June 26, 1913, File 87154, General Correspondence, 1894-1923, NARG77.
8. *Ibid.*
9. U.S. Attorney General to Secretary of War, Apr. 7, 1914, and attached correspondence, File 88247, General Correspondence, 1894-1923, NARG77.
10. *Ibid.*; *ARCE*, 1915, pp. 3077, 3083.
11. Theodore E. Burton to Maj. Harry Hodges, Jan. 10, 1907, File 53430, General Correspondence, 1894-1923, NARG77; Cong. John Langley to Chief of Engineers, Dec. 27, 1909, File 74273, *ibid.*; Maj. James G. Warren to Chief of Engineers (telegram), Jan. 8, 1910, *ibid.*; *ARCE*, 1909, p. 1834; *ARCE*, 1914, p. 1994.
12. Maj. J. C. Oakes to Chief of Engineers, May 27, 1911, File 80193, General Correspondence, 1894-1923, NARG77; *ARCE*, 1911, pp. 2195-97; on Maltby, see notes in *Engineering News* 65(Mar. 16, 1911):332-33; and 65(Mar. 30, 1911):398.
13. *ARCE*, 1913, pp. 2652-53; *ARCE*, 1914, p. 2820; Maj. Robert R. Ralston to Chief of Engineers, Feb. 4, 1916, File 80193, General Correspondence, 1894-1923, NARG77.
14. Maj. Robert R. Ralston to Gahren, Dodge & Maltby, Dec. 10, 1915, File 80193, General Correspondence, 1894-1923, NARG77; Maj. Robert R. Ralston to Chief of Engineers, Feb. 4, 1916, *ibid.*; Maj. Robert R. Ralston to H. G. McCormick, Mar. 21, 1916, *ibid.*; H. G. McCormick, "Retaining Wall Failure at Lock No. 13, Kentucky River," *Professional Memoirs, Corps of Engineers* 8(Nov. 1916):734-45.
15. *ARCE*, 1915, p. 3078; *ARCE*, 1916, pp. 2911-12; *ARCE*, 1917, pp. 3017-21; Maj. W. P. Stokey to Chief of Engineers, Dec. 12, 1916, File 7759, General Correspondence, 1894-1923, NARG77.
16. John Howe Peyton, "Traffic on the Ohio River," *Engineering News* 63(Feb. 17, 1910): 188-90.
17. *Ibid.*; *ARCE*, 1929, pp. 1294-95.
18. *Frankfort State Journal*, Jan. 21, 1917.
19. *Frankfort State Journal*, Jan. 28, 1917; Coleman, "Kentucky River Steamboats," pp. 320-21.
20. Edward H. Scheibler, "The Monongahela River Consolidated Coal & Coke Company," *S&D Reflector* 3(Sept. 1966):6-13; Edward H. Scheibler, "Decline and Fall of the Combine," *S&D Reflector* 5(Sept. 1968):6-10.
21. *Frankfort News*, June 21, 1910.
22. *Frankfort State Journal*, Feb. 8-15, 1917. John, Oscar Slack, and Johnston Barrett of Cincinnati founded the Frankfort Coal Elevator Company in 1889 with Capt. Riley Harpold managing its Frankfort operations. With the towboats *Al Martin*, *Alex Montgomery*, *E. T. Slider*, *Excel*, and others, the Barrett Lines barged as much as 100,000 tons of Monongahela coal annually from Cincinnati to Kentucky River customers.

23. Frankfort *State Journal*, Feb. 7 and 10, 1917; *ARCE*, 1917, p. 3021.
24. *Madison Courier*, June 23, 1917.
25. *ARCE*, 1917, pp. 3017-21; *ARCE*, 1918, p. 3069; CSX Corporation, "Taking Chances," *Connections* (No. 3, 1995):4-11, prints biography of Patrick Calhoun, Jr.
26. Benjamin F. Thomas to Chief of Engineers, May 13, 1918, File 6884, General Correspondence, 1894-1923, NARG77; Lt. Col. W. P. Stokey to Chief of Engineers, Mar. 8, 1922, File 92283, *ibid*.
27. *ARCE*, 1919, p. 3122-33; Lucien S. Johnson to District Engineer, Dec. 7, 1918, File 121861, General Correspondence, 1894-1923, NARG77.
28. Col. Lansing H. Beach, endorsement of Jan. 21, 1918, on Lt. Col. W. P. Stokey to Chief of Engineers, Jan. 18, 1918, File 6884, General Correspondence, 1894-1923, NARG77.
29. *ARCE*, 1918, p. 3069.
30. Lucien S. Johnson to District Engineer, Apr. 9, 1919, File 121861, General Correspondence, 1894-1923, NARG77; *ARCE*, 1919, p. 3122.
31. Coleman, "Kentucky River Steamboats," pp. 319-22; *ARCE*, 1920, p. 2758. *Sea Lion* burned on Oct. 28, 1919, at Kentucky River Mile 152.8.
32. *Lexington Leader*, June 30, 1938; *ARCE*, 1920, p. 2758; *ARCE*, 1923, p. 1266.
33. Bert Shearer, "Oliver F. Shearer and Sons: Recollections of a River Family," *S&D Reflector* 34(June 1997):6-12.
34. Betty Bryant, *Here Comes the Showboat* (Lexington, University Press of Kentucky, 1994), p. 121. Capt. Norman Thom of the showboat's crew and cast starred in Tarzan movies during the 1930s.
35. Stratton O. Hammon, "Kentucky Waterways by Canoe and Steamboat," *Filson Club History Quarterly* 39(Oct. 1965):334; C. W. Stoll, note in *S&D Reflector* 5(Mar. 1968):2; Coleman, "Kentucky River Steamboats," pp. 319-22.
36. U. S., Cong., House, *North Fork of Kentucky River*, H. Doc. No. 1101, 62d Cong., 3d Sess., 1912; Lt. Col. H. Jervy to Chief of Engineers, May 1, 1915, File 97513, General Correspondence, 1894-1923, NARG77; U. S., Cong., House, *South Fork of Kentucky River*, H. Doc. No. 414, 64th Cong., 1st Sess., 1915.
37. James Flinn to Lucien S. Johnson, Nov. 26, 1920, File 97513, General Correspondence, 1894-1923, NARG77.
38. *ARCE*, 1920, p. 2758, reported Kentucky River commerce increased during 1920 by 29 percent in tonnage and 57 percent in value.
39. Col. William W. Harts to Chief of Engineers, Mar. 1, 1921, File 45260, General Correspondence, 1894-1923, NARG77; Johnson, *Ohio River Division*, p. 89.
40. Lt. Col. William L. Sibert to Chief of Engineers, Jan. 16, 1915, File 84612, General Correspondence, 1894-1923, NARG77; Johnson, *Ohio River Division*, pp. 95-96.

12. THE RHINE OF KENTUCKY

1. *Louisville Times*, Sept. 27, 1922, is quoted at the chapter heading. *Louisville Courier-Journal*, May 13, 1928; Verhoeff, *Kentucky River*, p. 120; David F. Ross, "Mary Verhoeff Versus the Army Engineers on the Canalization of the Kentucky River," *Filson Club History Quarterly* 65(Apr. 1991):268-80.
2. Col. William W. Harts to Chief of Engineers, Mar. 1, 1921, File 45260, General Correspondence, 1894-1923, NARG77.

3. Ibid. Crews at Locks 12-14 were later reduced from three to two lockmen, and at these locks the Corps removed the central of the three lockhouses, opening a firebreak between the two remaining lockhouses.
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.
8. Ibid.; see also S. F. Wood Papers, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers, Louisville, KY. Naylor B. Humphrey succeeded Johnson in 1933 and Samuel Eversole replaced McCrackin and served until 1946; Barrett also served until 1946 when the Cincinnati District closed.
9. Ibid.; Col. William W. Harts to Col. William V. Judson, Apr. 25, 1921, Box NA2296, NARG77, Great Lakes Regional Records Center, Chicago, IL (NA location cited hereafter as Chicago, IL); G. W. Gourley to Albert Krell, Apr. 14, 1921, *ibid.*; Cong. Benjamin F. Welty to Col. William W. Harts, Apr. 15, 1921, *ibid.*; *Cincinnati Enquirer*, Mar. 23 and Apr. 9, 1921.
10. *ARCE*, 1920, pp. 2762-64; Lucien S. Johnson to S. F. Wood, May 4, 1920, S. F. Wood Papers, Historical Archives, Public Affairs Office, Louisville District, U. S. Army Corps of Engineers, Louisville, KY. Yet the Kentucky River project seems relatively safe compared with other projects; at Wilson Locks and Dam built on the Tennessee River during the 1920s, fifty-six workers lost their lives in accidents; and at Boulder Dam on the Colorado River completed in 1928 fatalities totaled ninety-eight. Not until Congress enacted workers compensation laws during the 1930s did occupational safety become a major concern on waterway projects and in the construction industry generally.
11. *Louisville Times*, Sept. 27, 1922.
12. *Ibid.*, and Aug. 11, 1928; *Louisville Courier-Journal*, June 24, 1923, May 13, 1928, and July 6, 1930.
13. C. H. McCrackin to S. F. Wood, Sept. 20, 1927, S. F. Wood Papers, Historical Archives, Public Affairs Office, Louisville District, U. S. Army Corps of Engineers, Louisville, KY.
14. Benjamin F. Thomas to District Engineer, Sept. 5, 1914, File 6884, General Correspondence, 1894-1923, NARG77. At Lock and Dam No. 13 in 1930, fishermen set off dynamite to kill fish, and the blast opened seeps through joints in the concrete dam; see Lucien S. Johnson to District Engineer, Jan. 3, 1931, Box NA1154, NARG77, East Point, GA.
15. John C. Schofield to Charles Gray, Sept. 11, 1914, File 6884, General Correspondence, 1894-1923, NARG77.
16. U.S. Attorney General to Secretary of War, July 6, 1901, and attached reports, File 37957, General Correspondence, 1894-1923, NARG77.
17. *Ibid.*
18. *Ibid.*
19. *Ibid.*
20. Col. Roger G. Powell to District Engineers, May 11, 1936, Box NA1150, NARG77, East Point, GA. This directive applied to all Ohio River tributary projects.
21. Lucien S. Johnson to District Engineer, Jan. 20, 1920, Box NA1151, NARG77, East Point, GA; Lucien S. Johnson to District Engineer, June 6, 1927, Box NA1150, *ibid.*; Frederick B. Duis and N. B. Humphrey to District Engineer, Dec. 5, 1936, *ibid.* The May 1927 flood wrecked Lock No.14's lower gates by smashing eighty lografts into the gates.
22. Lucien S. Johnson to District Engineer, Mar. 20, 1925, Box NA1154, NARG77, East Point, GA.

23. Ibid.

24. J. T. Kearney to District Engineer, "Survey of Kentucky River," Oct. 17, 1934, Box NA1151, NARG77, East Point, GA; Louis H. Prell to District Engineer, Oct. 24, 1934, *ibid.* See also John A. Walters, Lock No. 10 logbooks, Eastern Kentucky University, Richmond, KY, and Kentucky Historical Society, Frankfort, KY.

25. Frederick B. Duis to District Engineer, "Maintenance of Navigation Project on Kentucky River," Mar. 2, 1937, Box NA1141, NARG77, East Point, GA; Cincinnati Engineer District, *Histories of Navigation on the Ohio and Kentucky Rivers* (Cincinnati: U. S. Engineer District, 1937), *passim* (copy in *ibid.*)

26. Dix River dam is 1080 feet long, 287 feet high, with a 750-foot wide base and a 24-foot wide roadway on its crest. The 1.8 million cubic yards of rockfill dam is faced with concrete. A tunnel with steel penstocks through the right abutment carries water from the intake tower to three 7,500 KW turbogenerators in the powerhouse below the dam. Herrington Lake stores water from a 412 square-mile drainage area and has a storage capacity of 300,000 acre feet of water. See Kentucky Utilities Company, *75th Anniversary Pictorial History* (Lexington: Kentucky Utilities Co., 1987), pp. 8-10; General Information and Status, Kentucky River, Cincinnati Engineer District, May 1, 1939, Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers

27. Federal Power Commission issued permit No. 539 to Kentucky Utilities for developing power at Lock and Dam No. 7. Its three turbines connected through the piers to three 680 KW generators. L. F. Harza Company of Chicago designed the project for Kentucky Utilities. See Federal Power Commission Minutes, Nov. 27, 1929, S. F. Woods Papers, Historical Archives, Public Affairs Office, Louisville District, U. S. Army Corps of Engineers, Louisville, KY; General Information and Status, Kentucky River, Cincinnati Engineer District, May 1, 1939, *ibid.*; L. F. Harza to Lucien S. Johnson, Sept. 10, 1927, Box NA1150, NARG77, East Point, GA;

28. Capt. James D. Cleary, Report on Kentucky River, Dec. 31, 1931, Box 272-55, NARG77, East Point, GA; U. S., Cong., House, *Kentucky River, Kentucky*, H. Doc. No. 85, 73d Cong., 1st Sess., 1932. Capt. James D. Cleary and a Cincinnati District team drafted the report.

29. Capt. James D. Cleary, Report on Kentucky River, Dec. 31, 1931, Box 272-55, NARG77, East Point, GA; Lt. Col. C. L. Hall to F. C. Dugan, Aug. 9, 1934, Box NA1150, *ibid.*

30. Capt. James D. Cleary, Report on Kentucky River, Dec. 31, 1931, Box 272-55, NARG77, East Point, GA; Maj. Howard Yost to Division Engineer, Aug. 25, 1938, Box NA1129, *ibid.*; U. S. Public Health Service, *Ohio River Pollution Survey: Kentucky, Licking and Salt River Basins* (Cincinnati, OH: U. S. Public Health Service, 1942), III, 592-94. The Corps interviewed older residents who remembered droughts as far back as 1855 and agreed the 1930 flow was smaller than earlier droughts; the 1925 drought flow was less than 500 cubic feet per second for 122 days. Kentucky River streamflow at Dam No. 4 in August 1930 was 15 cubic feet per second; at Dam No. 14 in October 1930 it was only 6 cubic feet per second.

31. *Louisville Times*, Nov. 24, 1929, and July 18, 1930.

32. U. S. Public Health Service, *Ohio River Pollution Survey: Kentucky, Licking and Salt River Basins*, III, 589-92.

33. Frederick Duis to District Engineer, Nov. 5, 1937, Box NA1154, NARG77, East Point, GA.

34. *Ibid.*; N. B. Humphrey to District Engineer, Aug. 28, 1933, *ibid.*; N. B. Humphrey to District Engineer, Mar. 7, 1935, *ibid.* It required three workers in a boat eight hours to raise the 166 A-Frame wickets atop Dam No. 13 in 1933; pounding by drift and logs had bent many of them.

35. General Information and Status, Kentucky River, Cincinnati Engineer District, May 1, 1939, Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers. Maj. Howard Yost to Division Engineer, Aug. 25, 1938, Box NA1129, NARG77, East Point, GA, reported maximum flow at Frankfort in Jan. 1937 reached 85,000 cubic feet per second.

36. Lt. Col. D. O. Elliott to Division Engineer, Oct. 9, 1937, Box NA1128, NARG77, East Point, GA. U. S., Cong., House, Committee on Flood Control, *Comprehensive Flood Control Plan for*

Ohio and Lower Mississippi Rivers: Hearings on H. R. 7393 and H. RF. 7647, 75th Congress, 1st Session, 1937, authorized flood control studies in the Kentucky River basin.

37. Albe G. Barrett, Report of Operations ending December 31, 1942, Box 1152, NARG77, East Point, GA;

38. Louisville *Courier-Journal*, Nov. 18, 1928; Lt. Col. C. L. Hall to Division Engineer, May 22, 1936, Box NA1150, NARG77, East Point, GA; Maj. Howard Yost to Division Engineer, Aug 25, 1938, Box NA1129, *ibid.*

39. General Information and Status, Kentucky River, Cincinnati Engineer District, May 1, 1939, Historical Archives, Public Affairs Office, Louisville District, US Army Corps of Engineers; Lt. Col. C. L. Hall, District Memorandum No. 95, Mar. 29, 1934, Box NA1150, NARG77, East Point, GA; *Lexington Herald*, Aug. 31, 1932.

40. Lt. Col. C. L. Hall to Division Engineer, May 22, 1936, Box NA1150, NARG77, East Point, GA; Lt. Col. D. O. Elliott to Lt. Col. C. L. Hall, May 12, 1936, *ibid.*

41. Albe G. Barrett to N. B. Humphrey, Mar. 6, 1936, Box NA1150, *ibid.* By 1941 only six commercial firms traded on the Kentucky: John Littrel of Winchester and Virgil McClanahan of Ford owned saw mills at Irvine and used small towboats transporting logs to their mills; H. F. Lindsey offered charter towing at Frankfort; Yancey Merritt of Irvine operated excursion barges at Frankfort; J. B. Blanton towed sand and gravel between Frankfort and Madison, IN; and the Carrollton Coal and Sand Company barged coal and construction materials to its Carrollton terminal. See Domestic Transportation Lines with Headquarters in Cincinnati, Ohio, District, Box NA1141, *ibid.*; *Lexington Leader*, June 30, 1938.

42. John A. Walters, Lock 10 log, May 29, 1941, Kentucky Historical Society, Frankfort, KY; U.S., Cong., House, *Use of Barge Transportation for the Movement of Petroleum Products*, H. Doc. No. 731, 77th Cong., 2d Sess., 1942; P. W. Loveland and T. P. Bailey, "Navigation on the Ohio River," *Military Engineer* 41(May 1949):171-75.

43. Albe G. Barrett, Report of Operations for January 1942, Box NA1152, NARG77, East Point, GA; John Marr to District Engineer, July 30, 1942, Box NA1140, *ibid.*; Maj. Ralph J. Griffin to John Marr, Aug. 6, 1942, *ibid.*; Maj. W. H. Howard to A. D. Langford, Sept. 11, 1945, Box NA1154, *ibid.*

44. Col. B. C. Dunn to Chief of Engineers, Aug. 19, 1946, Box NA1155, NARG77, East Point, GA. An unusual obstruction blocked navigation near Lock No. 7 on the day the war ended in September 1945. A railroad refrigerator car loaded with Florida oranges derailed at High Bridge, rolled over the cliff, and fell into the river. Lockmaster William Simpson at Lock No. 7 reported this to headquarters, which saw to it that the railroad hoisted its carload of oranges out of the river; see. William H. Simpson to Lock No. 4, Sept. 3, 1945, Box NA1153, *ibid.*

45. Johnson, *Ohio River Division*, pp. 208-13, provides additional details and sources. When the Cincinnati District closed, George Burdorf was Chief of Operations and Maintenance; William F. Lail was Chief of Locks and Dams, and Alex Reese was Associate Superintendent of Kentucky River navigation. Lail remained at Cincinnati as Division navigation advisor, and a Kentucky River island at Mile 166.3 bears his name.

46. Thomas D. Clark, *The Kentucky* (Bicentennial edition; Lexington: University Press of Kentucky, 1992), pp. 4-5, 404.

13. KENTUCKY RIVER TRANSITION

1. Frankfort *State Journal*, Sept. 21, 1997, quotes Dr. Clark. Louisville *Courier-Journal*, May 18, June 20, 1951; *Louisville Times*, June 2 and July 2, 1951; *ARCE*, 1950, p. 1741; *ARCE*, 1951, p. 1418. The last appreciable commerce on the upper river was in 1946 when gasoline barges made deliveries to Clays Ferry and the Texola Refinery at Pryse shipped some gasoline downriver. Only one barge carrying pipeline equipment passed through Lock 10 during 1951, and Lockmaster Speed Cole reported passage of only one recreation craft through Lock 14 during June 1951.

2. Louisville *Courier-Journal*, June 22, 1951; *Louisville Times*, July 2, 1951; Caruthers A. Coleman was a Lexington contractor and George E. Tomlinson owned a Winchester mill making walnut gun stocks and hoped to barge logs down the Kentucky to his mill.
3. Louisville *Courier-Journal*, July 1 and 7, 1951; Robert G. West to Brig. Gen. A. W. Pence, July 9, 1951, A. W. Pence File, Historical Files, Ohio River Division, Cincinnati, OH.
4. *Courier-Journal*, July 15, 1951; *Louisville Times*, July 5, 10, and Aug. 24, 1951.
5. Gerald Griffin, "It's a Water Highway Once Again," *Courier-Journal Magazine*, Apr. 5, 1953, pp. 8-9; *Courier-Journal*, Apr. 23, 1953; *ARCE*, 1952, p. 1442; *ARCE*, 1954, pp. 913-14. Capt. Philip Richie of Paducah owned the 225-horsepower diesel towboat *Shamrock*, and its crew included Capt. Claude Carver, Bill Maloney, and Frank McKinney.
6. *Lexington Herald*, May 27, 1953, and Feb. 28, 1957. Capt. Claude Carver also piloted the *Josie* with Ollie Warner and E. B. Cornett, Jr., as crew. D. D. Stewart's company was named Blue Grass Minerals and shipped coal mined about six miles from Bellepoint.
7. *Courier-Journal*, May 22, Aug. 8, Dec. 11, 1953. Kentucky River Development Association meetings attended by Perkins were at Beattyville on Aug. 7, 1953, and at Jackson on Dec. 10, 1953.
8. Maj. Gen. Eugene Reybold to Secretary of War, Dec. 13, 1943, Box NA1162, NARG77, East Point, GA; Joe Creason, "A River Takes a Short Cut," *Courier-Journal Magazine*, Jan. 27, 1957, pp. 34-38; U.S. Army Corps of Engineers, Louisville District, *Plan of Study: Reconnaissance Level Investigation, Kentucky River and Tributaries, Jackson, KY* (Louisville: U.S. Army Engineer District, 1990), pp. 1-10. The Kentucky Highway Department widened the cutoff from 200 to 350 feet in 1962, but the project did not end flooding in Jackson, which suffered severe flood damage in 1984. A 25-foot wide tunnel had been excavated through the Panhandle before the Civil War to create water power for Bowman's grinding and saw mill, where flatboats and wooden coalboats were constructed; floods in 1898 and 1906 destroyed the mill.
9. *Courier-Journal*, Dec. 20, 1959; Leland R. Johnson, *The Falls City Engineers: A History of the Louisville District, U.S. Army Corps of Engineers* (Louisville: U.S. Engineer District, 1975), p. 264. The dam has maximum storage of 157,700 acre feet and a gated spillway through one of the deepest rock cuts in the United States.
10. Frankfort *State Journal*, Oct. 22, 1965; Neal Jenkins to Juanita Gass, Sept., 4, 1986, Box 077-173124, NARG77, East Point, GA. The 1938 Flood Control Act authorized Frankfort's floodwalls, requiring local government to obtain land for rights-of-way and to operate and maintain the completed project. North Frankfort floodwall included 3,300 feet of earthen levee averaging 28 feet high plus 700 feet of concrete wall, two pumping stations, and 4 closures, protecting to 1937 flood levels. South Frankfort floodwall construction was delayed until the city resolved controversies over its location and supplied the rights-of-way; it was completed in 1997. In January 1998, Congressman Hal Rogers broke ground for the Cy Bend Cut Through Project, an excavation through a river bend six miles downstream of Jackson, to further reduce flooding at that community.
11. Hazard, KY, *Hazard Herald*, June 8, 1961; Apr. 30, 1964; Apr. 14-15, 1966; Louisville *Courier-Journal*, May 2, 1966; Leland R. Johnson, *The Falls City Engineers: A History of the Louisville District, U.S. Army Corps of Engineers, 1970-1983* (Louisville: U.S. Army Engineer District, 1984), pp. 61-62; Kentucky, Department of Natural Resources, Division of Water Resources, *Water Crises in Kentucky* (Frankfort: Division of Water Resources, 1965), p. 21.
12. William O. Douglas, "The Public Be Damned," *Playboy*, July 1969, p. 188; Ray Harm, "Red River Gorge," *Kentucky Club Woman*, Jan. 1968, pp. 14-16; U. S. Army, Corps of Engineers, *Red River Reservoir, Kentucky: Reconnaissance Study* (Washington, DC: Office of the Chief of Engineers, 1968), passim; *Lexington Leader*, Feb. 17, 1975; Frankfort *State Journal*, Apr. 27, 1975; Johnson, *Falls City Engineers, 1970-1983*, pp. 15-21, 95-98, provides details and sources on the Red River controversy.
13. Louisville *Courier-Journal*, Dec. 11, 1978; Frankfort *State Journal*, Dec. 15 and 22, 1978; Winchester *Sun*, Dec. 27, 1978; Johnson, *Falls City Engineers, 1970-1983*, pp. 98-101; John Fetterman, "This River Could Die," *Courier-Journal Magazine*, June 28, 1970, pp. 8-12.

14. D. Field, Memo of Kentucky River Survey, July 18, 1980, Box 077-89-0001, NARG77, East Point, GA; General Overview of Kentucky River Navigation, 1978, Box 077-89-0001, *ibid.* Capt. John Donaldson of Nicholasville piloted the towboat *Sam Dreyer* pushing the sand barges to Frankfort; he purchased the towboat *Brooklyn* and towed barges of scrap metal from Brooklyn Bridge on the Kentucky to markets on the Ohio River.
15. Frankfort *State Journal*, Oct. 2, 1965; Col. Willard Roper to Brig. Gen. Walter P. Leber, Oct. 8, 1964, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers. The first Admirals boat parade occurred in 1963. The Kentucky Commissioner of Natural Resources confers the honorary rank of Kentucky River Admiral (Col. Edmund Taylor was the first Kentucky River Admiral), and the annual Admirals' regatta awarded prizes for the best-decorated boats, water skiing, swimming, and elected a "Miss Kentucky River." For recreational use of the Kentucky during the 1970s, see Richard Nugent, "A River for Pleasure," *Courier-Journal Magazine*, June 12, 1977, pp.10-14; and John Wilson, "That Old Kentucky River Is Still Moving Along," *Kentucky Happy Hunting Ground*, Jan. 1975, n. p.
16. Col. Robert R. Wessels to Brig. Gen. Willard Roper, Apr. 6, Aug. 7, Sept. 8, 1967, Historical Archives, Public Affairs Office, Louisville District, U. S. Army Corps of Engineers; *Lexington Herald-Leader*, May 5, 1968; U. S. Army Corps of Engineers, Louisville District, *Plan of Survey for Accomplishment of Kentucky River National Recreation Area Study* (Louisville: Planning Division, 1971), pp. 1-5; Col. Thomas P. Nack to Chief of Engineers, Feb. 27, 1979, Box 077-89-0001, NARG77, East Point, GA.
17. William F. Hughes to Leonard Vanzant, Feb. 1, 1973, File 1501-07, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; Jack Bleidt to Lockmasters, Dec. 13, 1974, *ibid.*; Col. Thomas P. Nack to Chief of Engineers, Feb. 27, 1979, Box 077-89-0001, NARG77, East Point, GA.
18. Col. James N. Ellis to Division Engineer, Apr. 6, 1977, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; Kenneth Matthews to Patrick Carrigan, n.d. (1978), *ibid.*; *Lexington Herald*, June 30, 1977.
19. Col. Thomas P. Nack to Chief of Engineers, Feb. 27, 1979, Box 077-89-0001, NARG77, East Point, GA.
20. Col. Thomas P. Nack, Notice of public meeting on interim closing of Locks 5 through 14, Lexington, KY, June 26, 1980, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; *Louisville Courier-Journal*, Sept. 26, 1981.
21. *Louisville Courier-Journal*, Sept. 26, 1981, and Feb. 11, 1982; Frankfort *State Journal*, Sept. 30, 1981; Notice to Navigation Interests, Apr. 10, 1982, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; Col. C. E. Eastburn to Carroll Hubbard, Jr., Aug. 5, 1982, *ibid.* During 1982, Louisville District assigned Randal Noe to superintend operations at Locks Nos. 5 through 10 staffed with temporary operators.
22. Col. C. E. Eastburn to Carroll Hubbard, Jr., Aug. 5, 1982, *ibid.*; James R. Rebmann and Suzanne M. Kilner, *Draft: A Multi-Purpose Surface Impoundment Proposal for the Kentucky River* (Lexington: Fayette County, 1987), p. 83, prints the Kentucky River Task Force interim report; Harrodsburg, KY, *Harrodsburg Herald*, Nov. 29, 1984; *Lexington Herald*, Nov. 16, 1984.
23. *Louisville Courier-Journal*, May 22, 1985; Rebmann and Kilner, *Draft: A Multi-Purpose Surface Impoundment Proposal for the Kentucky River*, p. 31; "Kentucky Continues Operating River Locks," *Land, Air and Water* 6(Spring 1994):17. During 1993 recreation season, 2,400 boats passed through some of Locks Nos. 5 through 14.
24. *Louisville Courier-Journal*, July 6, 1988; Col. James A. Ward, "Drought 88 After Action Report," (unpublished report, Cincinnati: Ohio River Division, 1989, in Historical Archives, Louisville District, U.S. Army Corps of Engineers), pp. 6-7; Gary A. O'Dell, "Water Supply and the Early Development of Lexington, Kentucky," *Filson Club History Quarterly* 67(Oct. 1993):431-61, provides useful history of Lexington's early water supply problems.
25. *Louisville Courier-Journal*, Dec. 1, 1988, and Jan. 20, 1989; Frankfort *State Journal*, Apr. 28, 1991.

26. Col. David Peixotto to Division Commander, Apr. 6, 1990, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; U.S. Army Corps of Engineers, Louisville District, *Kentucky River Locks and Dams 5 through 14: Priority Maintenance Repair Report* (Louisville: U.S. Army Engineer District, 1993), p. 1. The 1993, 1994, and 1996 Energy and Water Development Appropriations Acts provided \$13 million to repair Dams Nos. 5-14 to ensure water supply in preparation for ownership transfer to the Commonwealth.
27. Frankfort *State Journal*, Apr. 28, 1991, and Feb. 7, 1993; Kentucky River Authority, *Kentucky River Authority Annual Report, 1995* (Frankfort: Kentucky River Authority, 1995), p. 1.
28. *Kentucky River Authority Annual Report, 1995*, pp. 1-11; Hugh Archer to Kentucky River Authority Board, Apr. 15, 1996, Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers; Veronica L. Rife to Charles E. Parrish, June 21, 1996, *ibid.*; Thomas M. Dorman to Michael G. Barter, Sept 28, 1994, *ibid.*
29. John Fetterman, "This River Could Die," *Courier-Journal Magazine*, June 28, 1970, pp. 8-12; Richard Allen Wood, "Trouble in the Kentucky River Headwaters," *Kentucky Heritage* 12(Winter 1971-1972): 4-13; Louisville *Courier-Journal*, Feb. 10, 1989; *Lexington Herald-Leader*, Aug. 6, 1989; Frankfort *State Journal*, Feb. 7, 1993.
30. Frankfort *State Journal*, Feb 7, 1993.
31. David Porter, "Congressman Rogers Fights Eastern Kentucky's Battles in Washington," *Kentucky Explorer* 12(Oct. 1997):32-35; Section 531, Water Resources Development Act of 1996, directed the Corps to establish an environmental infrastructure program for southeastern Kentucky and authorized up to \$10 million for design and construction assistance; project planning began in May 1997.
32. Frankfort *State Journal*, Feb 7, 1993; "Civil Works Project Fact Sheet: Kentucky River Transfer Project, Nov. 25, 1996," Historical Archives, Public Affairs Office, Louisville District, U.S. Army Corps of Engineers.
33. Louisville *Courier-Journal*, Oct. 25, 1992, Sept. 11, 1993, and Dec. 6, 1996; *Kentucky River Authority Annual Report, 1995*, pp. 1-11; *Lexington Herald-Leader*, Sept. 29, 1997.
34. *Kentucky River Authority Annual Report, 1995*, pp. 1-11; Frankfort *State Journal*, Sept. 21, 1997.
35. Frankfort *State Journal*, Sept. 21, 1997, quotes Dr. Clark; the authors attended the dedication.

Kentucky River

BIBLIOGRAPHY

ARTICLES

- Adams, Lewis M. "An A-Frame Movable Top to Provide Increased Depths above Fixed Dams." *Professional Memoirs, Corps of Engineers* 3 (April 1911):332-34.
- Albjerg, Victor L. "Internal Improvements without a Policy." *Indiana Magazine of History* 28(June 1932):168-79.
- Baber, George. "Colonel J. Stoddard Johnston." *Register of the Kentucky State Historical Society* 14(January 1916):9-13.
- Beckner, Lucien. "John Findley: The First Pathfinder of Kentucky." *Filson Club History Quarterly* 1(April 1927):111-22.
- . "John D. Shane's Interview with Benjamin Allen, Clark County." *Filson Club History Quarterly* 5(April 1931):63-98.
- . "Eskippakithiki: The Last Indian Town in Kentucky." *Filson Club History Quarterly* 6(October 1932):355-82.
- . "John D. Shane's Interview with Jesse Graddy of Woodford County." *Filson Club History Quarterly* 20(January 1946):10-17.
- Calhoun, John C. "Roads and Canals," January 14, 1819, *American State Papers, Class X: Miscellaneous*, (Washington, DC: Gales and Seaton, 1838), II, pp. 533-37.
- Carson, W. Wallace. "Transportation and Traffic on the Ohio and the Mississippi before the Steamboat." *Mississippi Valley Historical Review* 7(June 1920):32-35.
- Clark, Thomas D. "The Lexington and Ohio Railroad." *Register of the Kentucky Historical Society* 31(January 1933):9-28.
- . "Kentucky Logmen." *Journal of Forest History* 25(July 1981):144-56.
- Clift, G. Glenn. "The Old Master, Colonel Orlando Brown, 1801-1867." *Register of the Kentucky Historical Society* 49(January 1951):5-24.
- Coleman, John W. "Kentucky River Steamboats." *Register of the Kentucky Historical Society Register* 63(October 1965):299-322.
- Coulter, E. Merton. "The Downfall of the Whig Party in Kentucky." *Register of Kentucky Historical Society* 23(May 1925):162-74.
- Cowdrey, Albert E. "Pioneering Environmental Law: The Army Corps of Engineers and the Refuse Act." *Pacific Historical Review* 44(August 1975):331-49.
- Cox, Betty. "Kentucky River, Early Highway for Settlers, Still Has Traffic." *Lexington Herald-Leader*, Bicentennial Edition, July 4, 1976.
- Coy, Fred E., Tom Fuller, Larry G. Meadows, and Don Fig. "Splash Dam Construction in Eastern Kentucky's River Drainage Area." *Forest and Conservation History* 6(October 1992):179-84.
- CSX Corporation. "Taking Chances." *Connections* (No. 3, 1995):4-11.
- Curry, Leonard. "Election Year—Kentucky, 1828." *Register of the Kentucky Historical Society* 55(July 1957):196-213.
- Dorris, Jonathan T. "Major Squire Turner, Lawyer, Statesman, and Economist." *Filson Club History Quarterly* 25(January 1951):33-50.
- Douglas, William O. "The Public Be Damned." *Playboy*, July 1969, pp. 143, 182-188.
- Dreier, Jeremy. "The Kentucky." *Kentucky Happy Hunting Ground*, March 1982, pp. 25-28.
- Durham, R. L. "Greensburg, the Capital of Green County, Has Rich History." *Kentucky Explorer* 12(May 1997):23-25.

- Ellwanger, Ella. "Famous Steamboats on Western and Southern Waters." *Register of the Kentucky Historical Society* 17(May 1919):17-39.
- . "Famous Steamboats and Their Captains on Western and Southern Waters." *Register of the Kentucky Historical Society* 18(January 1920):33-45.
- Fetterman, John. "This River Could Die." *Courier-Journal Magazine*, June 28, 1970, pp. 8-12.
- "Going to the Circus: Kentucky River Travel in 1886." *S & D Reflector* 33(June 1996):31.
- "Governor Gabriel Slaughter's Message." *Niles' Weekly Register* 13(Feb. 7, 1818):388.
- Gronert, Theodore G. "Trade in the Blue-Grass Region, 1810-1820." *Mississippi Valley Historical Review* 5(December 1918):313-23.
- Grubbs, James T. "Dutchess Cruises the Old Kentucky." *Lakeland Boating* (June-July 1958): 18-59, 19-35.
- Hackensmith, C. W. "John Fitch, A Pioneer in the Development of the Steamboat." *Register of the Kentucky Historical Society* 65(July 1967):187-211.
- Hale, John P. "History of the Great Kanawha River Slack Water Improvement." *West Virginia Historical Magazine* 1(April 1901):49-75.
- Hall, William M., and H. C. Corns. "Benjamin Franklin Thomas, M.ASCE." *Transactions of the American Society of Civil Engineers* 87(1924):1435-36.
- Hammon, Stratton O. "Kentucky Waterways by Canoe and Steamboat." *Filson Club History Quarterly* 39(October 1965):331-37.
- Harm, Ray. "Red River Gorge." *Kentucky Club Woman*, January 1968, pp. 14-16.
- Harrison, Lowell H. "Kentucky-Born Generals in the Civil War." *Register of the Kentucky Historical Society* 64(April 1966):129-60.
- . "James Wilkinson: A Leader for Kentucky?" *Filson Club History Quarterly* 66 (July 1992):334-68.
- Hart, J. H. "Logging on the Kentucky River." *Kentucky Explorer* 3(October 1988):5-10.
- Hodges, Duncan. "Harry Foote Hodges, M.ASCE." *Transactions of the American Society of Civil Engineers* 94(1930):1528-31.
- Howell, J. Roscoe. "Ashbel Welch, Civil Engineer." *Proceedings of the New Jersey Historical Society* 79 (1961):251-63.
- Hughes, Charlie G. "On the Kentucky River with Little Toot." *Heartland Boating*, August, 1991, p. 18.
- Hughes, Nicky. "Fort Boone and the Civil War Defense of Frankfort." *Register of the Kentucky Historical Society* 88(Spring 1990):148-62.
- Jackson, Carleton. "The Internal Improvement Vetoes of Andrew Jackson." *Tennessee Historical Quarterly* 25(Fall 1966):261-79.
- "James W. Cuyler." *Engineering News* 10 (April 21, 1883):189.
- Jillson, Willard R. "A History of the Kentucky Geological Survey." *Register of the Kentucky Historical Society* 19 (September 1921):90-112.
- . "Early Political Papers of Governor James Turner Morehead." *Register of the Kentucky Historical Society* 23(January 1925):36-61.
- Johnson, Leland R. "The Contest and Contract of 1824." *Military Engineer* 65(May-July 1973): 166-71, 252-57.
- . "Muscle Shoals Canal, Tennessee River." *Military Engineer* 63(July 1971):260-65.
- Johnston, J. Stoddard, "The Kentucky River in Its Relation to the Development of the Eastern Kentucky Coal Field." Part II of J. Stoddard Johnson and Basil W. Duke, *Transportation Systems together with a Review of Transportation Problems and Opportunities to be Solved* (Frankfort, KY: Capital Printing Co., 1887), pp. 51-65.

- _____. "The Kentucky River in Relation to the Development of the Eastern Kentucky Coal Field." *Seventh Annual Report from the Bureau of Agriculture*. Frankfort, Legislative Document No. 12, 1887.
- "Kentucky Continues Operating River Locks." *Land, Air and Water* 6(Spring 1994):17.
- "Kentucky River." *Engineering News* 14(January 31, 1885):80.
- Loveland, P. W., and T. P. Bailey. "Navigation on the Ohio River." *Military Engineer* 41 (May 1949):171-75.
- Luttrell, Cara, Katie Boyd, Charles Jones, and Gerald Courtney. "Are the Kentucky River's Locks Worth Saving?" *Frankfort State Journal Spectrum*, June 22, 1980.
- Mak, James, and Gary M. Walton. "The Persistence of Old Technologies: The Case of Flatboats." *Journal of Economic History* 33(June 1973):444-51.
- McAlpine, William H. "Elements Affecting Lock Construction on Canalized Rivers Having Fixed Dams." *Professional Memoirs, Corps of Engineers* 3(October 1911):587-90.
- McCalla, R. C. "Improvement of Black Warrior River." *Transactions of the American Society of Civil Engineers* (New York: 1902):283-84.
- McCormick, H. G. "Retaining Wall Failure at Lock No. 13, Kentucky River." *Professional Memoirs, Corps of Engineers* 7(November 1916):734-35.
- "Memoir of David Yancy Little." *Kentucky Explorer* 12 (June 1997):91.
- Moore, P. N. "Report on the Iron Ores and the Iron Manufacture of the Kentucky Red River Iron Region." *Geological Survey of Kentucky* 4(1877):15-34.
- Nettels, Curtis. "The Mississippi Valley and the Constitution, 1815-1829." *Mississippi Valley Historical Review* 11(December 1924):332-38.
- Nourse, James. "Journey in Kentucky in 1775." *Journal of American History* 19(Second Quarter, 1925): 121-38, 250-60, 351-644.
- Nugent, Richard. "A River for Pleasure." *Courier-Journal Magazine*, June 12, 1977, pp.10-14.
- O'Dell, Gary A. "Water Supply and the Early Development of Lexington, Kentucky." *Filson Club History Quarterly* 67(October 1993):431-61.
- Parrish, Charles E. "Navigation Development on the Kentucky River." *The Army Engineer* 3(March-April 1993):17-20.
- _____. "Building the Dam at Beattyville." *Kentucky Explorer* 11(April 1997):25.
- Paulson, F. M. "Boating through Boone's Country." *Field and Stream*, May 1958, pp. 50-51.
- Peyton, John Howe. "Traffic on the Ohio River." *Engineering News* 63(February 17, 1910):188-90.
- Porter, David. "Congressman Rogers Fights Eastern Kentucky's Battles in Washington." *Kentucky Explorer* 12(October 1997):32-35.
- "Rev. James Smith's Journal." *Kentucky History and Genealogy* 1(June 1899):53-64.
- Roberts, McCreary. "Rafting Days on Kentucky River Recalled." *Kentucky Explorer* 11(November 2, 1996):29.
- Robinson, Moncure. "Early Surveys and Reports in Reference to the Transmission of Trade across the Allegheny Mountains." *Transactions of the American Society of Civil Engineers* 15(1886):181-22.
- Ross, David F. "Mary Verhoeff Versus the Army Engineers on the Canalization of the Kentucky River." *Filson Club History Quarterly* 65(April 1991):268-80.
- _____. "Discovering the Kentucky River." *Heartland Boating*, April 1992, pp. 30-31.
- Ross, Jane. "Flatters and Keelers of the Western Rivers." *Early American Life* 8(February 1977):21-25, 60.
- Scheibler, Edward H. "The Monongahela River Consolidated Coal & Coke Company." *S&D Reflector* 3(September 1966):6-13.

- _____. "Decline and Fall of the Combine." *S&D Reflector* 5(September 1968):6-10.
- Shaler, Nathaniel S. "On the Improvement of the Rivers of Kentucky." *Bulletin of the Kentucky Geological Survey* (No. 1, 1879):13-21.
- _____, and John R. Proctor. "On the Importance of Improvement in the Navigation of the Kentucky River to the Mining and Manufacturing Interests of the Commonwealth." *Bulletin of the Kentucky Geological Survey* (No. 1, 1877):22-45.
- Shearer, Bert. "Oliver F. Shearer and Sons, Recollections of a River Family." *S&D Reflector* 34(June 1997):6-13
- Smith, Dwight L., ed. "The Ohio River in 1801: Letters of Jonathan Williams, Junior." *Filson Club History Quarterly* 27(July 1953):199-22.
- Smith, John F. "Salt-Making Industry of Clay County, Kentucky." *Filson Club History Quarterly* 1(April 1927):131-41.
- Snyder, Antes. "Pittsburgh—Her Waterways and Her Railways." *Transactions of the American Society of Civil Engineers* 28 (1903):24-25.
- Sprague, Stuart Seely. "The Louisville Canal: Key to Aaron Burr's Western Trip of 1805." *Register of the Kentucky Historical Society* 71(January 1973):69-88.
- _____. "Kentucky and the Navigation of the Mississippi: The Climatic Years." *Register of the Kentucky Historical Society* 71(October 1973):364-92.
- Starr, H. H. "Renewal of Kentucky River High Bridge." *Engineering News* 65(27 April 1911):518-21.
- Stuart, John G. "A Journal of Remarks or Observations in a Voyage down the Kentucky, Ohio, Mississippi Rivers &c." *Register of the Kentucky Historical Society* 50(January 1952):5-25.
- Sulzer, Elmer G. "Kentucky's Abandoned Railroads: The 'Riney-B'." *Kentucky Engineer* 8(February 1946):14-19, 28-30.
- _____. "Kentucky's Abandoned Railroads: Two Southern Segments." *Kentucky Engineer* 9(August 1947):15-21, 42-46.
- "Taking Chances: A Historic Look at American Commercial Lines." *Connections* (CSX Corporation journal) 3 (1995):5-11.
- Tanner, Helen H. "Cherokees in the Ohio Country." *Journal of Cherokee Studies* 3(Spring 1978):94-102.
- "The Kentucky River and Its Islands." *Register of the Kentucky Historical Society* 1(1903):40-41.
- Trescott, Paul B. "The Louisville and Portland Canal Company, 1825-1874." *Mississippi Valley Historical Review* 44(March 1958):686-708.
- Walker, Heber P. "Louisville and Portland Canal." *Indiana Magazine of History* 28(March 1932):21-30.
- Walker, John S. "Elements Affecting Lock Construction of Canalized Rivers Having Fixed Dams." *Professional Memoirs, Corps of Engineers* 3(October 1911):587-90.
- Watkins, J. S. "A Look at the Early Days of Kentucky's Highways & Roadbuilding." *Kentucky Explorer* 11(April 1997):8-11.
- Watt, John M. G. "Improvement of the Black Warrior." *Transactions of the American Society of Civil Engineers* (New York, 1902), pp. 283-84.
- White, Roy R. "The Salt Industry of Clay County, Kentucky." *Register of the Kentucky Historical Society* 50(July 1952):236-48.
- Wiley, Richard T. "Ship and Brig Building on the Ohio and Its Tributaries." *Ohio Archaeological and Historical Publications* 22(1913):54-64.
- Wilson, John. "That Old Kentucky River Is Still Moving Along." *Kentucky Happy Hunting Ground*, January 1975, n.p.

- Wilson, Samuel M. "Leestown—Its Founders and Its History." *Register of the Kentucky Historical Society* 29(October 1931):385-96.
- Wood, Richard Allen. "Trouble in the Kentucky River Headwaters." *Kentucky Heritage* 12(Winter 1971-1972):4-5, 13.
- Wright, Donald T. "One of Ohio's Valuable Tributaries." *Ohio River and Inland Waterways Magazine* 1(November 1919):28-29.
- . "The Blue Grass Waterway." *Ohio River and Inland Waterways Magazine* 1(April 1920):9-15.

BOOKS

- America's Wonderful Cliff Region, A Descriptive Letter with Illustrations of the Kentucky River Canyon by a Tourist on the Steamer Falls City.* Louisville: Owens Printing Co., 1908.
- Bakeless, John. *Daniel Boone*. Reprint. Harrisburg, PA: Stackpole Co., 1965.
- Baldwin, Leland. *The Keelboat Age on Western Waters*. Pittsburgh: University of Pittsburgh Press, 1941.
- Bishop, Joseph B., and Farnham Bishop. *Goethals, Genius of the Panama Canal*. New York: Harper & Bros., 1930.
- Bladen, Wilford A. *A Geography of Kentucky: A Topical-Regional Overview*. Dubuque, IA: Kendall-Hunt Publishing Co., 1984.
- Bryant, Betty. *Here Comes the Showboat!* Lexington: University of Kentucky Press, 1994.
- Butler, Laura, and Randolph N. Smith. *Cumberland County Will Records, 1815-1912*. Burkesville, KY: authors, 1976.
- Calico, Forrest. *History of Garrard County, Kentucky, and Its Churches*. New York: Hobson Book Press, 1947.
- Carroll County, KY. *Carroll County Year Book*. Carrollton, KY, 1909.
- Carroll, E. Malcolm. *Origins of the Whig Party*. New York: Da Capo Press, 1970.
- Castleman, John B. *Active Service*. Louisville: Courier-Journal Printing, 1917.
- Chinn, George M. *Kentucky Settlement and Statehood, 1750-1800*. Frankfort: Kentucky Historical Society, 1975.
- Clark, Edward. *William L. Sibert, the Army Engineer*. Philadelphia: Dorran & Co., 1938.
- Clark, Thomas D. *The Kentucky*. New York: Farar and Rinehart, 1942.
- . *Historic Maps of Kentucky*. Lexington: University Press of Kentucky, 1979.
- . *The Kentucky* (Bicentennial edition). Lexington: University Press of Kentucky, 1992.
- . *The Voice of the Frontier: John Bradford's Notes on Kentucky*. Lexington: University Press of Kentucky, 1993.
- . *Clark County, Kentucky: A History*. Winchester, KY: Clark County Historical Society, 1995.
- Coleman, J. Winston. *Stage Coach Days in the Bluegrass*. Louisville: Standard Press, 1935.
- . *Steamboats on the Kentucky River*. Lexington: Winburn Press, 1960.
- Collins, Lewis, and Richard H. Collins. *History of Kentucky*. Reprint; Berea, KY: Kentucke Imprints, 1976.
- Cresswell, Nicholas. *The Journal of Nicholas Cresswell, 1774-1777*. Second edition. New York: Dial Press, 1928.
- Crocker, Helen B. *The Green River of Kentucky*. Lexington: University of Kentucky Press, 1976.

- Daviess, Maria T. *History of Mercer and Boyle Counties*. Reprint. Harrodsburg, KY: Harrodsburg Herald, 1962.
- Davis, Dorothy. *John George Jackson*. Parsons, WV: McClain Printing Co., 1976.
- Downes, Randolph C. *Council Fires on the Upper Ohio: A Narrative of Indian Affairs in the Upper Ohio Valley until 1795*. Pittsburgh: University of Pittsburgh Press, 1968.
- Eaton, Clement. *Henry Clay and the Art of American Politics*. Boston: Little, Brown and Co., 1957.
- Ellis, William E., H. E. Everman, and Richard D. Sears. *Madison County: 200 Years in Retrospect*. Richmond, KY: Madison County Historical Society, 1985.
- Ellis, William E. *River Bends and Meanders: Stories, Sketches, and Tales of the Kentucky*. Burnsville, NC: Celo Valley Books, 1992.
- Every, Dale Van. *The Ark of Empire: The American Frontier, 1784-1803*. New York: William Morrow and Co., 1963.
- Filson, John. *The Discovery, Settlement and present State of Kentucke*. Reprint. New York, Corinth Books, 1962, of 1784 Wilmington, Del., edition.
- Folmsbee, Stanley J. *Sectionalism and Internal Improvements in Tennessee, 1796-1845*. Philadelphia: University of Pennsylvania Press, 1939.
- Fowler, Ida Earle. *Captain John Fowler of Virginia and Kentucky*. Cynthiana, KY: Hobson Press, 1942.
- Gaines, B. O. *History of Scott County*. 2 vols. Georgetown, KY: B. O. Gaines Printery, 1901.
- Gorin, Franklin. *The Times of Long Ago: Barren County, Kentucky*. Louisville: John P. Morton Co., 1929.
- Green, Karen M. *The Kentucky Gazette, 1787-1800*. Baltimore: Gateway Press, 1983.
- . *The Kentucky Gazette, 1801-1820*. Baltimore: Gateway Press, 1985.
- Hasse, Adelaide R. *Index of Economic Material in Documents of the States: Kentucky, 1792-1904*. Washington, DC: Carnegie Institution, 1910.
- Henry, Alfred J. *The Flood of 1913 in the Rivers of the Ohio and Lower Mississippi Valley*. Washington, DC: U.S. Department of Agriculture Bulletin Z, 1913.
- Hill, Forest G. *Roads, Rails & Waterways*. Norman, OK: University of Oklahoma Press, 1957.
- Hopkins, James F. *A History of the Hemp Industry in Kentucky*. Lexington: University of Kentucky Press, 1951.
- , and Mary M. Hargreaves, eds. *The Papers of Henry Clay, Vol. III: Presidential Candidate, 1821-1824*. Lexington: University of Kentucky Press, 1963.
- Hord, Lysander. *Letters in Relation to the Improvement of the Kentucky and Other Rivers, and the Kentucky Penitentiary*. Frankfort: A.G. and J. A. Hodges, 1877.
- Houchens, Miriam S. *History of Owen County, Kentucky, "Sweet Owen."* Louisville: Standard Printing, 1976.
- Hutchins, Thomas. *A Topographical Description of Virginia, Pennsylvania, Maryland, and North Carolina*. London: J. Almon, 1778.
- . *A Topographical Description of Virginia, Pennsylvania, Maryland, and North Carolina*. Reprint. Edited by Frederick C. Hicks. Cleveland: Burrows Bros., 1904.
- Jessamine County Historical and Genealogical Society. *Jessamine County, Kentucky*. Dallas, TX: Taylor Publishing Co., 1993.
- Jillson, Willard R. *Early Frankfort and Franklin County, Kentucky*. Louisville: Standard Printing Co., 1936.
- . *Literary Haunts and Personalities of Old Frankfort, 1791-1941*. Frankfort: Kentucky Historical Society, 1941.
- Johnson, Leland R. *The Falls City Engineers: A History of the Louisville District, Corps of Engineers, United States Army*. Louisville: US Army Engineer District, 1975.

- _____. *Engineers on the Twin Rivers: A History of the Nashville District, Corps of Engineers*. Nashville: US Army Engineer District, 1978.
- _____. *Men, Mountains and Rivers: A History of the Huntington District, Corps of Engineers*. Huntington, WV: US Army Engineer District, 1977.
- _____. *Addison N. Scott: Kanawha River Canalization, 1875-1901*. Huntington, WV: US Army Engineer District, 1979.
- _____. *The Headwaters District: A History of the Pittsburgh District, Corps of Engineers*. Pittsburgh, PA: US Army Engineer District, 1979.
- _____. *The Falls City Engineers: A History of the Louisville District, Corps of Engineers, United States Army, 1970-1983*. Louisville: US Army Engineer District, 1983.
- _____. *The Davis Island Lock and Dam, 1870-1922*. Pittsburgh, PA: US Army Engineer District, 1985.
- _____. *The Ohio River Division: The History of a Central Command*. Cincinnati, OH: US Army Engineer Division, 1992.
- _____, and Jacques S. Minnotte. *The Headwaters District Roundtables: An Eyewitness History of the Pittsburgh District*. Pittsburgh, PA: US Army Engineer District, 1986.
- Johnson, L. F. *The History of Franklin County*. Frankfort: Roberts Printing Co., 1912.
- Johnston, J. Stoddard. *First Explorations of Kentucky*. Louisville: John P. Morton Co., 1898.
- _____, and Basil W. Duke. *Transportation Systems together with a Review of Transportation Problems and Opportunities to be Solved*. Frankfort, KY: Capital Printing Co., 1887.
- Kentucky. Office of State Treasurer. *200 Years of Kentucky Treasurers*. Frankfort: Office of State Treasurer, 1992.
- Kentucky River Navigation Company. *Charter, Meeting of Corporators, and Address of the Executive Committee of the Kentucky River Navigation Company*. Frankfort: Osborne and Co., 1865.
- Kentucky Utilities Company. *Kentucky Utilities Company, A Pictorial History*. Lexington: Kentucky Utilities Co., 1987.
- Kerr, Charles, ed. *History of Kentucky*. 4 vols. Chicago: American Historical Society, 1922.
- Kleber, John E., ed. *The Kentucky Encyclopedia*. Lexington: University Press of Kentucky, 1992.
- Kramer, Carl E. *Capital on the Kentucky: A Two Hundred Year History of Frankfort & Franklin County*. Frankfort: Historic Frankfort, Inc., 1986.
- Lancaster Woman's Club. *Patches of Garrard County*. Danville, KY: Bluegrass Printing, 1974.
- Lee County High School. *Glimpses of the Three Forks Country*. Beattyville, KY: Lee County High School, 1975.
- Lee County Historical Society. *Lee County History*. 2 vols. Beattyville, KY: Powell Press, 1987.
- Lytle, William, and Forrest Holdcamper. *Merchant Steam Vessels of the United States, 1790-1868*. Second edition, revised. Staten Island, NY: Steamship Historical Society of America, 1975.
- McClanahan, Ralph E. *Brief History of the Kentucky River*. Irvine, KY: author, 1971.
- _____. *Kentucky's Miniature Nile*. Frankfort: Kentucky Department of Natural Resources, 1972.
- McIntosh, John, and Jane Brandenburg. *Lee County, Yesterday and Today*. Beattyville, KY: Lee County High School, 1976.
- McKee, Lewis W., and Lydia K. Bond. *A History of Anderson County*. Frankfort: Roberts Printing Co., 1937.
- Mereness, Newton D. *Travels in the American Colonies*. New York: Antiquarian Press, 1961.
- Meyer, Leland W. *Georgetown College: Its Background and a Chapter in its Early History*. Georgetown, KY: Georgetown College, 1929.

- _____. *The Life and Times of Colonel Richard M. Johnson of Kentucky*. New York: Columbia University Press, 1932.
- Morgan, Kelly. *History of Clay County, Kentucky, 1767-1976*. Manchester, KY: Morgan Book Co., 1976.
- Mosgrove, George Dallas. *Kentucky Cavaliers in Dixie*. Louisville: Courier-Journal Printing Co., 1895.
- Niquette, Chuck M., and A. Gwynn Henderson. *Background to the Historic and Prehistoric Resources of Eastern Kentucky*. Alexandria, VA: Bureau of Land Management, 1984.
- O'Malley, Nancy. *Stockading Up: A Study of Pioneer Stations in the Inner Bluegrass Region of Kentucky*. Lexington, KY: University Press of Kentucky, 1987.
- _____. *Searching for Boonesboro*. Lexington, KY: University Press of Kentucky, 1989.
- Poague, George R. *Henry Clay and the Whig Party*. Chapel Hill: University of North Carolina Press, 1936.
- Prospectus of the Three Forks Investment Company: Its Beattyville Town Site*. Louisville: Courier-Journal Printing Co., 1889.
- Reid, Robert L., ed. *Always a River: The Ohio River and the American Experience*. Bloomington, IN: Indiana University Press, 1991.
- Remini, Robert V. *Andrew Jackson and the Course of American Democracy, 1833-1845*. New York: Harper & Row, 1984.
- Robertson, James R. *Petitions of the Early Inhabitants of Kentucky to the General Assembly of Virginia, 1769-1792*. Louisville: Filson Club Publications No. 27, 1914.
- Ruffner, Ernest H. *The Practice of the Improvement of the Non-Tidal Rivers of the United States*. New York: J. Wiley & Sons, 1885.
- Shaler, Nathaniel S. *The Autobiography of Nathaniel Southgate Shaler*. New York: Houghton Mifflin Co., 1909.
- Shallat, Todd. *Structures in the Stream: Water, Science, and the Rise of the U.S. Army Corps of Engineers*. Austin, TX: University of Texas Press, 1994.
- Snyder, Robert. *A History of Georgetown College*. Georgetown, KY: Georgetown College, 1979.
- Spencer, Jeanena, Donna Spencer, and Cynthia Cook. *Glimpses of the Three Forks Country, Beattyville, KY*: Lee County High School, 1975.
- Sprague, Stuart, and Elizabeth Perkins. *Frankfort: A Pictorial History*. Virginia Beach, VA: Donning Co., 1980.
- Sutphin, Gerald W., and Richard A. Andre. *Sternwheelers on the Great Kanawha River*. Huntington, WV: authors, 1991.
- Tapp, Hambleton, and James C. Klotter. *Kentucky: Decades of Discord, 1865-1900*. Frankfort: Kentucky Historical Society, 1977.
- Taylor, George R. *The Transportation Revolution, 1815-1860*. Vol. IV of *Economic History of the United States*. New York: Rinehart and Co., 1951.
- Taylor, Richard, and Adam Jones. *The Palisades of the Kentucky River*. Englewood, CO: Westcliffe Publishers, 1997.
- Thomas, Benjamin, and D. A. Watt. *The Improvement of Rivers*. New York: John Wiley and Sons, 1913.
- Timberlake, Henry. *Memoirs, 1756-1765*. Edited by Samuel C. Williams. Johnson City, TN: Watauga Press, 1927.
- Tweet, Roald. *A History of the Rock Island District, Corps of Engineers*. Rock Island, IL: US Army Engineer District, 1975.
- Verhoeff, Mary. *The Kentucky Mountains: Transportation and Commerce, 1750 to 1911*. Louisville: John P. Morton & Company, 1911.

- _____. *The Kentucky River Navigation*. Louisville: John P. Morton Co., 1917.
- Walton, John. *John Filson of Kentucke*. Lexington: University of Kentucky Press, 1956.
- Ward, Harry M. *Charles Scott and the Spirit of '76*. Charlottesville: University Press of Virginia, 1988.
- Way, Frederick, Jr. *Way's Packet Directory, 1848-1983*. Athens, OH: Ohio University, 1983.
- _____. *Way's Steam Towboat Directory*. Athens, OH: Ohio University, 1990.
- Wegmann, Edward. *The Design and Construction of Dams*. New York: John Wiley & Sons, 1922.
- Wells, J. W. *History of Cumberland County*. Louisville: Standard Printing Co., 1947.
- Wood, Richard G. *Stephen H. Long, 1784-1864*. Glendale, CA: Arthur H. Clark Co., 1966.
- Young, Bennett H. *History and Texts of the Three Constitutions of Kentucky*. Louisville: Courier-Journal Printing., 1890.
- _____. *A History of Jessamine County, Kentucky*. Louisville: Courier-Journal Printing Co., 1898.

GOVERNMENT PUBLICATIONS

- Kentucky. Department of Natural Resources. *Water Crises in Kentucky*. Frankfort: Department of Natural Resources, 1965.
- Kentucky. Department of Natural Resources. Division of Water Resources. *The Floods of April*. Frankfort: Division of Water Resources, 1977.
- Kentucky. Fish Commission. *Second Annual Report of the Fish Commission*. Frankfort: E. H. Porter, 1879.
- Kentucky. General Assembly. *House Journal, 1818-1880*. Serial set. Frankfort: General Assembly, 1819-1881.
- _____. *Senate Journal, 1824-1880*. Serial set. Frankfort: General Assembly, 1825-1881.
- _____. *Legislative Documents, 1840-1868*. Serial set. Frankfort: General Assembly, 1841-1868.
- _____. *Kentucky Acts*. Serial set. Frankfort: General Assembly, 1820-1880.
- _____. Geological Survey. *Geological Surveys of Kentucky*. Vol. 3. Frankfort: Geological Survey, 1877.
- _____. *Bulletin of the Kentucky Geological Survey*. Frankfort: Geological Survey, 1877.
- Kentucky River Authority. *Annual Report, 1995*. Frankfort: Kentucky River Authority, 1996.
- Kentucky River Task Force. *Final Report of the Kentucky River Task Force*. Frankfort: Legislative Research Commission, 1993.
- Littell, William. *The Statute Law of Kentucky*. 5 vols. Frankfort: William Hunter, 1809-1819.
- Rebmann, James R., and Suzanne M. Kilner. *Draft: A Multi-Purpose Surface Impoundment Proposal for the Kentucky River*. Lexington: Fayette County, 1987.
- U.S. Army Corps of Engineers. *Kentucky River Surveyed under the Direction of Lt. Turnbull by Lieuts. Grayson and Buford*. 8 maps. Washington, DC: US Army Corps of Engineers, 1829.
- _____. *Annual Report of the Chief of Engineers*. Serial set. Washington, DC: Government Printing Office, 1867-1994.
- _____. *Red River Reservoir, Kentucky: Reconnaissance Study*. Washington, DC: Office of the Chief of Engineers, 1968.
- _____. Louisville District. *Plan of Survey for Accomplishment of Kentucky River National Recreation Area Study*. Louisville: US Army Corps of Engineers, Planning Division, 1971.

- _____. Louisville District. *Kentucky River and Tributaries, Upper Kentucky River Navigation Project, Situation Report*. Louisville: US Army Engineer District, 1980.
- _____. Louisville District. *Kentucky River Locks and Dams 5 through 14: Priority Maintenance Repair Report*. Louisville: US Army Engineer District, 1993.
- U. S. Public Health Service. *Ohio River Pollution Survey: Kentucky, Licking and Salt River Basins*. Vol. 3. Cincinnati, OH: US Public Health Service, 1942.
- U. S. War Department. *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*. 128 vols. Washington, DC: Government Printing Office, 1880-1901.

CONGRESSIONAL DOCUMENTS

- U.S., Congress, House. *Survey—Kentucky River*. House Document No. 58, 20th Congress, 1st Session, 1829.
- _____. *Congressional Record*. 45th Congress, 2d Session, 1878.
- _____. *Deterioration of River and Harbor Works*. House Document No. 230, 56th Congress, 1st Session, 1900.
- _____. *Preliminary Report and Examinations of the North Fork of Kentucky River*. House Document No. 1101, 62nd Congress, 3rd Session, 1911.
- _____. *Report of the Ohio River Flood Board*. House Document No. 246, 63rd Congress, 1st Session, 1913.
- _____. *Preliminary Examination of the South Fork of the Kentucky River*. House Document No. 414, 64th Congress, 1st Session, 1915.
- _____. *Kentucky River, Kentucky*. House Document No. 85, 73rd Congress, 1st Session, 1933.
- _____. Committee on Flood Control. *Comprehensive Flood Control Plan for Ohio and Lower Mississippi Rivers: Hearings on H. R. 7393 and H. RF. 7647*, 75th Congress, 1st Session, 1937.
- _____. *Use of Barge Transportation for the Movement of Petroleum Products*. House Document No. 731, 77th Congress, 2d Session, 1942.
- _____. *Disposition of Kentucky River Locks and Dams*. House Document No. 99-49, 99th Congress, 1st Session, 1985.
- U.S. Congress. Senate. *Reports and Draughts of Surveys for the Improvement of Harbors and Rivers and the Construction of Roads and Canals*. Washington, DC: Gales and Seaton, 1839.
- _____. *Report on the Memorial of George Stealey*. Senate Report No. 274, 35th Congress, 1st Session, 1858.
- _____. *Relief of D. R. Haggard*. Senate Report No. 650, 43rd Congress, 2nd Session, 1875.

NEWSPAPERS

- Beattyville, KY. *Beattyville Enterprise*.
- Cincinnati, OH. *Centinel of the North-West Territory*.
- Frankfort, KY. *Frankfort Commonwealth*.
- _____. *Frankfort News*.
- _____. *Frankfort Paladium*.

_____. *Frankfort Roundabout*.
 _____. *Kentucky Yeoman*.
 _____. *State Journal*.
 _____. *Yeoman*.
 Harrodsburg, KY. *Harrodsburg Herald*.
 Hazard, KY. *Hazard Herald*.
 Lexington, KY. *Kentucky Gazette*.
 _____. *Lexington Herald*.
 _____. *Lexington Herald-Leader*.
 _____. *Lexington Leader*.
 Louisville, KY. *Courier-Journal*.
 _____. *Evening Post*.
 _____. *Louisville Journal*.
 _____. *Louisville Times*.
 _____. *Public Advertiser*.
 Madison, IN. *Madison Courier*.
 Richmond, KY. *Globe*.
 Winchester, KY. *Winchester Sun*.

ARCHIVAL RECORDS

Atlanta, GA. National Archives. Southeast Region. Record Group 77, Records of the US Army Corps of Engineers.
 Beattyville, KY. Lee County Public Library. Vertical historical files.
 Boonesborough, KY. Fort Boonesborough State Park. John A. Walters Papers.
 Bowling Green, KY. Western Kentucky University. Kentucky Library. Manuscript Section. Family Register of Joseph R. Underwood, 1834-1850.
 Carrollton, KY. Carroll County Public Library. Vertical historical files.
 Chicago, IL. National Archives. Great Lakes Region. Record Group 77, Records of the US Army Corps of Engineers.
 _____. Record Group 41, Records of Bureau of Marine Inspection and Navigation.
 Cincinnati, OH. U.S. Army Engineer Division. Historical Files.
 Frankfort, KY. Kentucky Historical Society Library, Manuscript Section.
 _____. State Library and Archives. Legislative Documents.
 _____. Executive Documents. Governor James B. McCreary Papers.
 _____. Auditor of Public Accounts. Board of Internal Improvement Papers.
 Irvine, KY. Estill County Public Library. Vertical historical files.
 Lexington, KY. University of Kentucky. M. I. King Library. Division of Special Collections and Archives. John Halley Journals.
 Louisville, KY. Filson Club. Historical Archives. Orlando Brown Papers.
 Louisville, KY. Louisville Public Library. Vertical historical files.
 Louisville, KY. U.S. Army Engineer District. Public Affairs Office. Historical Archives.

_____. Operations Division Files.

_____. Planning Division Files.

Madison, IN. Madison Public Library. Vertical historical files.

Owenton, KY. Owen County Public Library. Vertical historical files.

Richmond, VA. Virginia State Archives. Monongalia Navigation Company Papers.

Washington, DC. Library of Congress. Cartographic Division. Kentucky River Maps.

Kentucky River

INDEX

- Abutments, 44, 48-49, 53, 56-60, 67-68, 72, 88, 96, 105-06, 111, 124, 136
- Access, 39, 91, 127; see Markets
- Accidents, 25, 27, 55, 66-67, 72, 87, 98, 101, 103, 114, 145-49
- Accounts, 41, 73, 88-89, 97, 121, 145; see Audit
- Acid mine drainage, 152-53
- Acquisition, see Real Estate
- Adams, John Quincy, 21-23
- Adjutant General, 91
- Administration, 73, 120, 138, 147; see Districts, Divisions, Chief of Engineers
- Advance*, 138
- Aetna Refining Company, 139
- A-frame wickets, 127-28, 144, 153, 155
- Agriculture, 3, 7, 8-9, 13, 19, 24, 27, 35, 37, 60, 69, 73, 76, 78, 79, 86, 91, 99, 108, 113
- Alabama, 18, 20, 30, 38
- Alex. Montgomery*, 108
- Allan, Chilton, 21, 42-43
- Allegheny Portage Railroad, 36
- Allegheny River, PA, 104
- Al Martin*, 208
- American Commercial Barge Lines, 138
- American Electric Power Company, 140
- American system, 16, 20, 28
- Anderson, Mercer, and Woodford Navigation Company, 71
- Appalachians, 1, 8, 18, 25
- Appraisal, 60; see Real estate
- Appropriations, 13, 15-28, 30, 36, 41, 43, 45, 75, 81, 88-89, 93-94, 99, 135, 165
- Archaeology, 2-3; see Native American Indians
- Argo*, 27, 29, 55; see *New Argo*
- Armstrong, Charles, 147
- Armstrong, John, 12, 27, 29, 50-51
- Army Engineers; see U. S. Army Corps of Engineers
- Asher Lumber Co., 115
- Assistant engineers, 36, 98, 107-10, 121, 135-36, 142, 144-45, 144-45, 149-50; see names of assistant engineers
- Assistant Secretary of the Army (CW), 163
- Attorney General, 72-73
- Attorneys, 59, 72, 82; see U. S. Attorney
- Aubrey, John, 145
- Audit, 41, 77, 80, 82, 84, 88
- Automobiles, 143, 146, 152
- Auxiliary dams, 120, 126, 144
- Bacon College of Engineering, 42, 71-72
- Baesler, Scotty, 165
- Baker, Edward, 145
- Baker, R. Philip, 30-37, 65
- Ballman, Charles, 162
- Baltimore, MD, 9, 24
- Barbour Joseph, 39, 42, 56-60, 63-64
- Barbourville, KY, 31, 35-36
- Barclay, N. B., 61
- Barges, 9, 37, 45, 70, 79, 83, 88, 96, 98, 109, 112, 116, 135, 137-40, 144, 147, 149-50, 154-55, 158-59, 161-62; see Towboats
- Barren County, KY, 82
- Barren River, KY, 23, 25-26, 46
- Barrett, Albe G., 145
- Barrett Lines, 137
- Bars (sand or gravel), 2, 5, 10, 22-23, 31, 61, 70, 74, 154
- Barton, Teresa, 168
- Bankruptcy, 52-54, 56, 82, 121, 131-35
- Banks, 24, 41, 43, 46, 52, 60, 64, 73, 80, 132-34
- Banks (river), 4-5, 48, 72; see Erosion
- Basin, 2, 131, 153-54, 160; see name of watershed
- Bates, James P., 79, 82
- Bates, John, 11
- Bayou du Chein, KY, 46
- Beach, Lansing H., 139
- Beaches, 146; see Recreation
- Beartraps, 100-03, 105
- Beatty, Samuel, 86
- Beattyville, KY, 1, 10, 69, 72, 86, 92, 94, 98-103, 105, 111, 115, 117, 123-24, 126, 129, 131-34, 136-41, 144, 150-55, 159, 161
- Beattyville dam, 98-103, 111

- Beaver River, PA, 26, 32
- Belle*, 140
- Bellefontaine, OH, 122
- Bellepoint, KY, 158-59, 162
- Bells, 147-48
- Benefits, 19, 27, 47, 55, 60, 76, 97-98, 105, 108, 115-17, 129, 135-36, 141-42, 145; see Costs
- Bentley, Ernest, 145
- Berry, Albert S., 93
- Berry, Roy, 162
- Bertha M.*, 140
- Bidgood, Clarence, 158-59
- Bids, 38-40, 42, 46, 101, 107, 111, 120, 124, 135; see Contracts
- Big Benson Creek, KY, 23, 39, 60
- Big Sandy River, KY, 28, 104, 121, 127-28, 130, 145, 157
- Bissett and McMahon, 89
- Blasting, 103, 124
- Bleidt, John R., 162
- Bluegrass, 1, 3, 15, 29-30, 91, 93, 98, 158, 161, 166
- Bluewing*, 54, 63, 68-71, 83, 85, 108
- Board of Internal Improvement, 15-90, 149; organization of, 30, 47, 55, 69, 76, 82, 84
- Boat Club, 91, 146
- Boats, see type or names of boat
- Boatyards, 9, 154; see Marine way, Repair Depot
- Bob Gresham*, 154
- Bob Letcher*, 62, 66
- Bogges, James, 145
- Bonds, 27, 41, 43-44, 46, 48, 52, 55-57, 59-50, 65, 70-71, 93, 132, 167
- Booms, 58, 110, 115-16, 119, 125-26, 130
- Boondoggle, 161; see Porkbarrel
- Boone, Daniel, 5, 8, 161, 167
- Boonesborough, KY, 1, 4-5, 7, 9, 17, 22, 61, 114, 120, 123, 146, 153, 161, 166-68
- Booneville, KY, 115, 141, 150-51, 153
- Bowling Green, KY, 23-25, 46, 62, 82, 102
- Boulders; see Rocks
- Bourbon, 83; see Whiskey
- Bourbon Democracy, 91, 93, 167
- Bracelet*, 83
- Bragg, Braxton, 91
- Bramlette, Thomas, 84-86
- Breach, 80, 85-86, 90, 92, 94-95, 97-98, 120, 124-25
- Breathitt, Edward, 160-61
- Breathitt, John, 23-24, 26
- Breckinridge, John C., 86, 91
- Bridges, 1, 14, 27, 37, 54, 73, 81, 86, 101-02, 114-15, 122, 143
- Brooks, John T., 58, 61
- Brownski, James, 112
- Brown, John Mason, 86, 114
- Brown, Moreau, 86, 89-90
- Brown, Orlando, 29-31, 35, 39, 51, 137
- Brown, William, 82
- Brownsville, PA, 5, 46
- Bryant, Billy, 140
- Buchanan, G. and A., 29
- Buckhorn, 151, 153, 160-61, 165
- Buckhorn Watershed Association, 160
- Buckner, Richard, 21, 24
- Buckner, Simon Bolivar, 91
- Buck Shoals, 18-20, 23
- Buck, Thomas, 162
- Budget, 10, 42, 53, 74, 78, 80, 88, 159, 163; see Taxes, Finances
- Buffalo, 4-5
- Buford, Napoleon B., 17, 22, 30-32, 35-36, 47, 59
- Bullitt, J. J., 90
- Bullock, J. M., 44
- Burkesville, KY, 77, 84, 89
- Burnett* (towboat), 113, 150
- Burnett, R. S., 101-02, 109
- Burnside, Ambrose, 83
- Burton, Theodore, 135
- Bush, Charles, 168
- Bush, John, 47
- Bush, Walter P., 149
- Business, 55, 60, 63, 98-99, 108; see Economics, types of businesses
- Caisson, 56-57
- Calcite, 140
- Calhoun*, 12-13
- Calhoun, John C., 12, 16-17

- Calhoun, Patrick, Jr., 138, 140
- California, 59, 76
- Canalization, see Canals, Locks and dams
- Canals, 17-18, 21, 23-26, 31, 25, 31, 35-36, 38, 63
- Canoes, 2-6, 14, 44, 152
- Callaway, Richard, 5-7
- Camp Nelson, KY, 10, 12, 37, 83, 154, 158, 160
- Capital, 15, 24, 27-28, 41, 69, 71, 83, 86, 93, 135, 167; see Investment, Finances
- Capital, 1, 29-30, 39, 43, 49-50, 105, 152, 160, 168; see Frankfort, KY.
- Caps, 105, 107, 122
- Capstans, 157
- Cargo, 8-10, 35, 54, 64-66, 79, 83-84, 98, 108
- Carr Creek, KY, 160
- Carr Fork, KY, 160-61
- Carroll County, KY, 56, 86
- Carroll, Julian, 161
- Carrollton* (dredge), 113, 150
- Carrollton, KY, 1, 4, 8-9, 31, 34, 37, 40, 45, 58, 62, 74, 79, 85-86, 95, 97, 113, 116, 139-40
- Castleman, John, 85
- Cates, Owen G., 69, 72-73, 80
- Cattle, 2, 4, 65, 79, 84
- Cedar Creek, KY, 10, 34, 39, 79, 85; see Lock and Dam No. 3
- Cement, 38-40, 50, 53, 60, 74, 102-03, 122-23; see Concrete
- Central Division, 120, 128, 139, 141-42, 144-45
- Ceres*, 9
- Chambers, lock, 26, 34-35, 37, 52, 65, 71, 84, 88, 94, 96, 109, 121
- Channel clearance, 15, 17-20, 36, 112; see name of river channel
- Channel depth, 34, 37, 127
- Channels, 2, 5-6, 11-15, 74, 96, 124-27
- Chanoine wicket dams, 99-100
- Charles Miller*, 83
- Charming Polly*, 4
- Charming Sally*, 4
- Charter, 10
- Chenoka* (towboat), 113
- Cherokee, 3-4
- Chief Engineer, 30-31, 36, 42, 47; see names of chief engineers
- Chief of Engineers, 22, 93-94, 96-97, 99, 102-03, 108, 116-17, 120, 122, 125, 128, 129, 131, 135, 145, 148, 150; see names of Chief
- Chinn mines, 140, 154
- Chittenden, R. H., 64-65
- Cholera, 73-75
- Chute, 6, 100-02
- Cincinnati, OH, 1-2, 56-58, 62, 66, 73-74, 88, 93-94, 97, 109, 120, 131-32, 135, 137-43, 145-46, 150, 154-55, 161
- Cincinnati Engineer District, 93-94, 108, 120-21, 135, 138, 142, 144-45, 148, 150, 154-55
- Cincinnati Southern Railway, 111
- Citizens Trust Bank, 132-34
- City of Clarksville*, 108, 126
- City of Frankfort*, 96
- Civil engineers, 14, 20, 24, 27, 29-42, 47, 76, 92-93, 111, 121, 125, 138
- Civilization, 1-3, 14-15, 49, 60, 62, 152-53, 157, 168
- Civil War, 18, 21, 62, 72, 80-86, 94, 116, 136, 149, 158
- Civil works, see Internal Improvements, Navigation, Locks and Dams
- Claims, 52, 59-61, 83-84, 121
- Clarence*, 147
- Clark, George Rogers, 4-5
- Clark, Thomas D., i, 156-57, 168
- Clarke, Samuel, 29
- Clarksburg, WV, 25
- Clay, Cassius M., 70
- Clay City, KY, 11
- Clay County, KY, 11, 46
- Clay, Henry, 15-17, 20-23, 28
- Clay Lick, KY, 10, 77, 79
- Clay, R. A., 62
- Clays Ferry, KY, 30, 69-70, 72, 155, 159
- Claysville, KY, 46
- Clear Creek, KY, 151
- Clements, Earle, 158, 160
- Clifton, KY, 61-62, 146
- Clinton*, 29
- Clinton County, KY, 77
- Closure, 143, 154-68

- Coal, 1, 30, 35, 37, 41, 45, 46, 64, 69-70, 74, 76, 78, 83, 88-92, 94, 97-99, 107, 113, 116-17, 119-21, 123, 129-30, 132, 136-39, 143, 151-52, 154-55, 157-59, 161-62
- Coalboats, see Coal
- Codell, James C., 168
- Cofferdam, 38, 42-43, 53, 102, 109, 111, 123, 132-33, 136
- Cogar, Thomas, 62, 88
- Coleman, Caruthers, 158
- Collection, 59, 64, 83-84, 89; see Tolls
- College Hill, KY, 127, 140
- Collins, Martha Layne, 163-64
- Commerce, 3, 8-15, 17-20, 29-30, 37, 42, 46, 42, 61-62, 65, 70, 73-74, 83, 87, 104, 108, 115-17, 126, 129-32, 141, 144-45, 151, 154-55, 157-62; at Beattyville, 99-100, 141; see Flatboats, Ships, Steamboats, Towboats, Railroads, Roads
- Commodities, 8-10, 13, 16, 29, 74, 108, 115-16, 143; see Commerce, names of commodities
- Commonwealth, 1, 10, 12, 14-15, 18, 20-22, 26, 28-30, 35-36, 42-43, 47, 52-55, 59-60, 65-66, 71, 74-76, 80-82, 88, 90-92, 96, 105, 117, 123-24, 131, 136, 143, 149, 150, 157-68; see Kentucky
- Commonwealth Towing Company, 162
- Communications, 15, 24, 42
- Competition, 63, 65, 77, 80, 98, 104-05, 108, 137
- Comprehensive planning, 15, 24, 131
- Concrete, 105, 119-30, 129, 132-42, 144, 166; see Cement
- Condemnation, 110
- Conemaugh River, PA, 26, 32, 34, 36
- Confederates, 47, 81-86, 91-92
- Congress, 17, 20-21, 94, 96-98, 103-04, 105, 107, 109, 114, 117-18, 135, 138, 141, 145, 151, 153-54, 158-61, 163
- Conn, Thomas, 66, 73
- Constitution, 20-22, 76-78
- Construction, see Locks and Dams, names or types of structures
- Contingencies, 37, 39, 53, 111, 125
- Contractors, see Contracts, names of contractors
- Contracts, 12-13, 20, 31, 36, 38-61, 71, 74, 82, 88, 89, 95, 101, 107, 109, 111-12, 117, 119, 121, 123-24, 132-36; see Bids, Specifications, names of contractors
- Conventions, 69-70, 75
- Conway, Ralph, 162
- Conway, Sidney, 145
- Cooper, Vernon, 160
- Corps, see U. S. Army Corps of Engineers
- Corps of Engineers; see U. S. Army Corps of Engineers
- Corrosion, 153
- Costs, 19, 23-24, 26-27, 34-35, 37, 40, 45, 47-48, 57, 60, 63, 65, 67, 69, 71-72, 74, 78, 81, 87, 96-97, 99, 103, 108-09, 111-12, 115-17, 124, 127, 129, 132, 134, 136, 141, 145, 150, 154, 162, 167; see Benefits, Investments, Finances
- Council Bluffs, IA, 13
- Counties, 1, 10, 70-71, 86, 89, 93; see name of county
- Covington, KY, 32, 74, 148
- Cox, Austin P., 30, 66, 73, 77
- Cox, Earl, 145
- Craig, Elijah, 9
- Craig, John, 7
- Craighill, William P., 99
- Crests, 119, 123, 127-30, 132-33, 139, 144-45, 153, 166
- Creswell, Nicholas, 4-5
- Cribs, see Timbercribs
- Crime, 134, 146-49; see Law enforcement
- Crittenden, John J., 72
- Crozier, John, 8
- Cubbage, George, 83
- Cummings, Samuel, 9
- Current, 6, 7, 9, 25, 38, 107, 109; see Flow, Floods
- Cumberland County, KY, 77, 89
- Cumberland Ford (Pineville), KY, 35
- Cumberland Gap, 5, 31, 35
- Cumberland River, 1, 18, 23, 28, 31, 35-36, 46, 83, 104, 128, 130, 154, 161
- Culverts, 41; see Valves
- Cutoff walls, 166
- Cuyler, James, 94-98, 107, 142
- Dalton, Jesse, 162
- Damages, 33, 51-53, 55, 59-61, 66, 72-73, 81, 84-86, 102, 124-26, 139, 149-50, 153-54, 157, 161; see Accidents, Floods
- Dams, 5, 10-11, 13-14, 18-20, 25, 32-33, 48, 77; movable, 92 98-103, 119, 127-30; timbercrib, 105-18; concrete, 119-30; Nos. 13 and 14, 131-42; flood control, 157-61; see Locks and dams, Cofferdams, Wingdams, Fishtrap dams, Mills, Hydroelectric

- Daniel, G. W., 99
- Danville, KY, 74
- Dark and bloody river, 29
- Darling, Thomas and Adam, 39, 60
- Daviess, Samuel, 52
- Dawson, Robert, 163
- Dayton, OH, 127, 131
- Dees, Charles, 162
- Dees, Russell, 162
- Defense, 15-16, 81
- Deficits, 53, 55, 69, 71, 80-81, 88-90, 97; see Budget, Finances
- Diesel engines, 126, 141
- Democratic party, 21, 23-24, 28, 48, 77, 82, 167
- Democratic Republican party, 16, 21, 28, 91
- Depot, 105, 113; see Repair depot
- Depression, 28, 60, 116, 143, 154; see Economics
- Derricks, 109-10, 112, 127, 132, 150, 152, 159
- Desha, Joseph, 18
- Design, canoes, 3-4; flatboats, 6-9; keelboats, 9; ships, 9; saltboats, 11; steamboats, 12-13;
- navigation locks, 16, 25-27, 31, 36, 67, 108-09, 131-32; lock lift, 111; movable dams, 98-103, 127-30; timbercrib dams, 25-26, 31, 105-18; concrete dams, 119-42
- Development, 76, 81, 88, 90-91, 104
- Dewater, 53, 88, 123; see Cofferdams, Pumps
- Disasters, 91-104, 124-25, 139-40, 149, 153, 160-61; see Hazards, Safety, Emergency, Floods
- Discharge, 32; see Flow, Floods, Low water
- Disease, see Health
- Distilleries, 152, 159
- District Engineers, 113-14, 120-21, 124, 126-27, 135, 144, 148, 150, 154; see Districts, names of District Engineers
- Districts, 93-94, 108, 122, 138; see Cincinnati Engineer District, Louisville Engineer District
- Divers, 129, 150
- Divisions, 120, 128, 154; see Central Division, Ohio River Division
- Dixie*, 138
- Dixie Belle*, 165
- Dix River, 5, 8-9, 150
- Dix River Dam, 150
- Docks, 161; see Landings, Wharf
- Dorman, Thomas, 166-68
- Douglas, William O., 160
- Drakes Creek, KY, 93
- Drawings, 38, 42
- Dredge, 10, 34, 74, 77, 87-88, 106-07, 112-13, 110, 112, 127, 150, 154
- Drennon Lick, KY, 11, 79
- Dreyer, Whitehead, and Goedeke Company, 161
- Driftwood, 25, 31, 51, 66, 73, 80, 84, 103, 128; see Logs, Timber
- Drill, 110
- Drought, 2, 14, 19, 44, 75, 143, 151-52, 165; see Water supply
- Dufour, Jean J., 10
- Dugouts, 4-5,
- Dunn, B. C., 155
- Dyer, Dillis, 73
- Dynamite, 124; see Blasting
- Eastin, Henry, 36, 47, 53
- Economics, 15-16, 27-28, 34-35, 41-41, 46, 52-53, 55, 60, 65, 76, 88, 90, 92, 94, 116, 126, 141-45, 163; see Costs, Benefits, Investments, Finances
- Education, 42, 49, 71-72; see Schools
- E. F. Jackson*, 140
- Elections, 23-24, 48, 77, 80, 91, 93; see names of political parties
- Electric, see Hydroelectric, Coal
- Elkhorn Riffle, 6
- Embargo, 9, 65, 162
- Emergency, 57-58, 64, 66, 80, 82, 85-88, 96, 111, 124-25, 131, 143, 149-50, 152-53, 161, 165; see Hazards, Disasters, Floods, Drought
- Employ, see Labor
- Empress*, 29-30
- Energy, 137-38, 143, 150-51, 154-55, 162; see Coal, Hydroelectric
- Engineers, 14, 24-25, 29-42, 47, 55-56, 58-59, 71-72, 89, 92, 103, 124; see Civil engineers, U. S. Army Corps of Engineers, names of engineers
- Environment, 1-6, 14, 33-34, 91, 146-47, 151-53, 161, 167-68; see Resources
- Era of Good Feelings, 14, 16, 18
- Erie canal, NY, 18, 36
- Erosion, 1-2, 25, 48, 57-58, 67, 72-73, 75, 96, 102, 107, 124-25, 144
- Eskippakithiki, KY, 3

- Essex Island, KY, 10, 34
- Estel II*, 140, 149
- Estill County, KY, 45
- Estimates, 37-38, 40, 59, 65, 71, 74, 85, 92-94, 97, 99, 108, 111, 116, 136; see Costs
- Europeans, 3-6
- Evans, James S., 47, 64
- Evansville, IN, 129
- Eversole, James, 145
- Eversole, Samuel, 150
- Examinations, see Surveys
- Excavations, 13, 49, 56-58, 106, 127
- Excel*, 108, 137
- Exchange*, 12-13
- Excursions, 140, 147
- Expedition*, 12-13
- Experiments, 18, 23, 25-26,, 34-35, 50, 78, 87, 100, 105
- Exploration, 3-6
- Exports, 8-10, 19, 29, 65, 67, 92
- Failures, 66, 82, 103, 124-25, 132; see Accidents, Bankruptcy
- Fall (gradient), 2, 4-5, 10, 18-19, 22, 31, 36, 62, 85; see Ripples
- Falls City, 52, 61; see Louisville, KY
- Falls City*, 12, 61, 104, 137
- Falls of the Ohio, 18; see Louisville and Portland Canal
- Farms, see Agriculture
- Fashion*, 63
- Favorite*, 70
- Fayette, Madison, Clarke, and Estill Navigation Company, 71
- Federal Bureau of Investigation, 155; see Crime
- Ferry, 4, 6-7, 19, 61, 146-47, 151; see names of ferries
- Fetterman, John, 166
- Filson, John, 1, 5
- Finances, 23-24, 27, 41, 43, 46, 52, 81, 145, 157-68; see Economics
- Finney, Richard, 162
- Finns Ripple, 108
- Fish, 3, 5, 13, 79, 91, 114, 143, 146; see Recreation
- Fisherman, 146; see Fish
- Fishtrap dams, 13, 28, 31, 45
- Fishtrap Island, 10-11, 13, 23
- Fitchburg, KY, 11
- Fitzhugh, Robert H., 92, 94-98, 103, 136
- Flanking, 48, 57-58, 96-97, 119, 122, 124-27, 130, 132, 144
- Flashboards, 155, 166
- Flatboats, 2-12, 19, 31, 64, 70, 78, 79, 82, 96, 168
- Fleet, see Floating plant, Repair depot
- Floating plant, 105, 112-13
- Flood control, 131-32, 144, 151, 153-54, 157-60
- Floodgates, 52
- Floodplain, 60
- Floods, 2, 4, 13, 25, 27, 31-35, 42-43, 51, 55, 57-58, 66, 78, 91-92, 96, 101-03, 119, 124-25, 127-28, 131, 134, 143-145, 149, 151-53, 156, 161
- Floodwalls, 153-54, 157, 160-61
- Flour, 9, 59
- Flow, 2, 11, 14, 31, 45, 49, 75, 107, 125, 127, 165; measurement of, 32; see Floods, Drought, Low water, Water supply
- Fluorspar, 140
- Flynn, Pete, 160
- Folly, 57, 97-98, 102
- Ford, KY, 101, 115, 119, 124, 140, 159, 161
- Ford, Wendell, 165
- Foreclosure, 54; see Bankruptcy
- Forests, 27, 42, 91, 143; see Trees, Lumber, Logging
- Fort Boone, 83
- Fortifications, 81, 83
- Fort Pitt, PA, 4-5
- Fossils, 1, 49
- Foster, Stephen Collins, 36, 58
- Foster, William B., 26, 36, 58
- Foundations, 26, 31, 34, 38, 49, 51, 53, 56-58, 75, 93, 95, 100-01, 107, 109-10, 127
- French, Richard, 48
- Frankfort* (dredge), 113
- Frankfort, KY, 1, 5-6, 8-13, 19, 22-24, 26-27, 29-31, 32, 34, 37, 39, 41, 43, 45, 47, 50-54, 58-59, 61-70, 74-75, 77, 80, 82-83, 86-89, 91-94, 96-98, 105, 108, 113-14, 116-17, 131, 135, 137-40, 143-44, 149-54, 157-58, 160-61, 163, 166-68
- Frankfort Boat Club, 91, 146
- Frankfort Commonwealth*, 26-27, 29, 39, 51, 61, 66-68, 74, 76
- Frankfort Repair Station, 113, 135, 139, 145, 149-50, 154-55

Franklin County, KY, 60, 92-93, 97
 Franklin, William, 83
 Freeman, Charlie, 145
 Funding, 27, 43, 115-18, 135; see Appropriations, Finance, Investments, Capital, Matching funds
 Furnaces, 41, 45, 87; see Iron
 Gahren, Dodge and Maltby Company, 135
 Garrard County, KY, 70-71, 75
 Garrard, James, 11, 45
 Gasboats, 126, 140-41, 143
 Gasoline, 146, 154-55, 158, 161; see Gasboats, Oil
 Gatun Locks, 135
 General Assembly, see Legislature, Commonwealth
General O. M. Poe (snagboat), 113, 124-25
General Scott, 9
 Generators, 150-51
 Geological Survey, 91-92
 Geology, 1-2, 91-92, 110
George Madison, 13
 Georgetown, KY, 9, 71-72, 91
 Georgetown College, 42, 71-72
Georgie, 119
 Gest, KY, 151
Ghent, 108
 Ghent, KY, 86
 Gilbert's Ripple, KY, 34
 Gilley, Charles, 159
 Gillmore, Quincy A., 83
Go-by, 9
 Golden, James, 160
 Goose Creek, KY, 11, 35-36, 41, 45, 70, 87, 116
 Gorge, 1-2, 124, 139, 160-61, 168; see Palisades
 Gorman, William, 160
Governor Shelby, 13
 Governors, 2, 20-21, 24, 27, 29-30, 41, 43, 47, 50, 54, 75, 84, 90-91, 123, 148, 158, 160-61, 163-65; see names of governors
Grace Morris, 108-09, 126
 Graham, Campbell, 22
 Grainger, W. H., 74
 Grand Canyon of the East, 1-2
 Gratiot, Charles, 22-23
 Gratz, KY, 10, 31, 77
 Grayson, John B., 17, 22
 Great Southern Refining Company, 140
 Green River, KY, 15, 17-18, 22-28, 30-31, 36, 38-39, 41-42, 45-47, 50, 52-53, 62-63, 68, 73, 81-82, 84-85, 87-89, 102, 104, 111, 158
 Green River Railroad, 41, 47
Greenwood, 72
 Greenup Island, 10
Gregory (towboat), 113, 138, 150
Grey Eagle, 73
 Guardwalls, 109, 139
 Guerrillas, 81, 83, 85-86
 Guidewalls, 75, 100-02, 109, 111, 114, 138
 Gulf of Mexico, 3, 17
 Gulf Refining Company, 154, 161
 Gulley, Earl, 162
 Guthrie, James, 21
 Haggard, David Rice, 69, 77-82, 84-90
 Hales Bar Lock and Dam, 121
 Hall, C. Lacey, 154
 Handbury, Thomas H., 119-20
Hardy L. Roberts, 154
 Harlan, James, 30
 Harris, J. B., 138
 Harrod, James, 4-5
 Harrodsburg, KY, 4, 46, 62
Harry Raike, 138
 Harts, William W., 110-11, 116-17, 141-42, 144-45
 Harvard University, 92, 103
 Harvie, Lewis, 99
Hattie Brown, 108
 Hawkins, Martin, 10-11
 Hayes, Rutherford B., 93-94
 Hazard, KY, 138, 141, 160
 Hazard Coal Operators Association, 158
 Hazards, 2, 4-6, 10-11, 14, 55, 57-58, 72, 75, 85, 114-15, 124-25, 128, 145; see Safety
Hazel Dell, 83
 Headwaters, 1, 91-92, 119-20; see Three Forks
 Health, 33, 35, 48, 73, 75, 84, 97
 Heidelberg, KY, 126, 135-36

Hemp, 73, 75-76, 86, 92, 94; see Rope
 Henry County, KY, 85-86
 H. E. Talbott Co., 127-28
Hibernia, 108
 Hickman Creek, KY, 8-10, 12, 37
 Hickman, John, 30
 High Bridge, KY, 110-12, 116, 147, 150, 165
 Highline, 112, 127
 High water (flow), 6, 13, 29-31, 43, 62, 72, 95-96, 101, 115, 141; see Rain, Floods, Tides
 Highways, 1, 3, 5, 8, 21, 42, 141, 152-53, 161, 168; see Roads, Turnpikes
 Historians, 21, 65, 91-92, 103, 143, 153, 156-57, 168
 Hoag, Israel V., 107-08
 Hodges, Harry, 123
 Holton, John, 62-63, 71, 73, 83
 Holton, Robert, 83
 Hopkins, Larry, 163
 Hopkinsville, KY, 47
 Hord, Lysander, 92, 94, 97
Hornet, 96, 114
 Horses, 2, 6-7, 24, 29, 56-57, 65, 70, 72, 79, 88, 99, 111
 Horseshoe Bend (ripple), 31, 34, 39; see Lock and Dam No. 1
 Hotel, 59, 61, 66, 74
Hotspur, 108
 Houseboats, 7-8
 Housing, 95; see Lockhouses
 Hubbell, William, 29
 Hudson River, NY, 146
 Hughes, William, 162
 Hulme, John, 40, 74
 Hunter, Huber, 145
 Hyden, KY, 160
 Hydraulic cement, 38-40, 50, 53, 60, 74
 Hydroelectric power, 132, 143, 150-51
 Hydrology, 1-2, 31; see Floods, Precipitation, Low water, Droughts
 Ice, 2, 25, 27, 49, 62, 70, 91, 98, 124-25, 139, 155
 Income, see Salary, Finances
 Imports, 29, 65
 Impoundment, see Dams, Pools
 Improvement; see Internal improvement
 Indiana, state, 18, 41, 45, 78, 109, 112, 124, 159
 Indians, 3-5, 7; see Native Americans
 Industry, 32, 42-43, 81, 119, 124, 152, 160; see Mills, Manufacturing, Commerce
 Ingerson, Philo, 46
Ingomar, 102, 126
 Inspection, 40, 42, 47, 55-56, 72-73, 84, 97, 120-21, 134, 144-45; see Resident Engineer
 Instone, John, 9
 Internal improvement, 10-11, 13-28, 29
 Interstate commerce, 20, 137; see Commerce
 Inverness, KY, 86
 Investigation, 97; see Audit
 Investments, 15, 18, 20-21, 23, 27-28, 43-44, 47, 63, 65-66, 71, 75, 86-87, 89, 92, 94, 98, 101, 136
 Iron, 11, 13, 26, 34-35, 37-38, 41, 45, 46, 51, 74, 76-78, 87, 91, 94, 98-99, 101, 105, 110, 116
 Irvine, KY, 3-4, 40, 68-71, 116, 124, 126, 129, 138, 140, 152, 154
Isaac Shelby, 62-63, 67
 Islands, 5-6, 10-11
 Jacks Creek Ferry, 7
 Jackson, Andrew, 11, 17, 21, 23, 42
 Jackson, John George, 25
 Jackson, KY, 58, 123, 141, 160
James Guthrie, 54
 James River and Kanawha canal, 18
Jane, 9
 Jarvis, William, 9
 Jefferson, Thomas, 8-9
 Jeffersonville, IN, 74
 Jessamine, Boyle, and Garrard Navigation Company, 71
 Jessamine County, KY, 68, 86, 89
 Jessamine Creek, KY, 153, 158, 160
 Jessee, George M., 81, 85-86
 Jett Transportation Company, 140
J. J. Kelley, 154
John A., 126
John H. Soell, 141
Johnson, 12-13
 Johnson, George W., 47
 Johnson, James, 12-13
 Johnson, Lucien S., 142, 144-45, 149-50

- Johnson, Richard M., 12
- Johnson, Rowland, 145
- Johnston, Albert Sidney, 91
- Johnston, J. Stoddard, 86, 91-93, 98, 103, 137, 146
- Johnston, Thornton, 41, 71
- Johnstown, PA, 26, 32
- Jones, Thomas, 9
- Jordan, John, Jr., 9
- Josie*, 159
- Journals, 2, 4-6,
- Jump, 61, 79, 107
- Kaltenbacker, W. S., 154
- Kanawha River, 11, 18, 78, 87, 97-98, 100, 104, 116, 121, 123, 140, 151
- Keelboats, 9-10, 19, 31, 62, 64, 79
- Kentucky* (steamboat), 12, 63, 73
- Kentucky* (snagboat), 101, 109, 111-14, 131, 150, 154
- Kentucky, definition, 3
- Kentucky Central Railroad, 101
- Kentucky Colonels, 146
- Kentucky Press Association, 91
- Kentucky Progress Commission, 146
- Kentucky River, characteristics, iii-1v; course and length of, 1; geology of, 1-2; early commerce, 1-14; origins of state project, 15-28; construction of state locks and dams, 29-68; state project operations and maintenance, 69-90; civil war on, 81-90; origins of federal project, 91-104; construction of federal locks and dams, 105-30; project operations from 1917 to 1940, 131-42; operations from 1941 to 1980, 143-56; transition to state control, 157-68
- Kentucky River Admirals, 146, 161
- Kentucky River Authority, 163-68
- Kentucky River basin, 2, 131, 153-54, 160, 165
- Kentucky River Basin Steering Committee, 165
- Kentucky River Development Association, 158-59
- Kentucky River Mills, 75, 92, 102
- Kentucky River Museum, 167
- Kentucky River Navigation Company, 10, 76, 86-90
- Kentucky River Railroad Company, 72
- Kentucky River Sweep, 166
- Kentucky River Task Force, 163
- Kentucky River View Park, 167-68
- Kentucky Towing Company, 139
- Kentucky Union Railroad, 103
- Kentucky Utilities Company, 150-52
- Kentucky Water Patrol, 163
- Kentucky Yeoman*, 91-93, 103
- Kiskiminetas River, PA, 26
- Knobs, 1, 3
- Knott, Wilson, 40, 44, 60
- Kwasind* (snagboat), 112
- Labor, 20-21, 24, 27, 30, 42-43, 48, 56-57, 75, 85, 87-88, 95, 97-99, 101, 109, 122, 124, 128, 134, 155; see Lockmasters, Repair party
- Lacock, Abner, 26
- L. A. Fulton*, 108
- Lake Park, 92
- Lambert, John, 162
- Lancaster*, 108
- Landing, 104, 146; see Steamboats, names of landings
- Land, see Real Estate
- Land owners, 60, 110, 161
- Langley, John, 135
- Lansdale, Isaac, 13
- Laurel Branch, 151
- Law enforcement, 64, 113-14, 134, 148-49
- Lawrenceburg, KY, 152, 164
- Lawson, John, 162
- Layoffs, 97, 121, 125, 155, 162
- Leakage, 67, 69, 75, 77, 84, 112, 122, 166
- Lease, 63, 74, 89-90, 92, 101, 163-65
- Leatherwood Creek, KY, 31
- LeBarron, William, 54
- Ledges, rock, 5-6, 129
- Lee County, KY, 100, 164; see Beattyville, Three Forks
- Lee, Dwayne, 163
- Lee, Hancock, 5
- Lee's Ripple, KY, 34, 39; see Lock and Dam No. 4
- Lee, Robert E., 92, 103
- Leestown, KY, 5, 12-13
- Legislature, 10-11, 13, 17-19, 24, 26-27, 30, 35, 41-56, 59-60, 62, 66, 70-72, 74-77, 80, 82-90, 93, 163-68; see Commonwealth, Congress
- Lehigh River, PA, 32, 34, 36
- Leitch, Curtis, 150
- Letcher, Robert, 48, 52-54

- Levees, 153-54, 160
- Lexington, KY, 8-9, 11-13, 17-18, 20, 23, 30, 45, 47-48, 52, 56, 62-63, 69-70, 72, 74, 85, 88, 137, 150, 152, 155, 158-59, 161, 163, 165
- Lexington and Ohio Railroad, 15, 23-24, 26, 29, 41-42, 53-54, 62-63, 66-67, 74, 77-78
- License, 7-8, 10-11
- Licks, 3, 10-11; see Springs
- Licking River, KY, 15, 17-18, 22, 26-28, 30-32, 36, 41-42, 46-47, 53, 59
- Lift, lock, 34, 74, 111, 117, 121, 127
- Limestone, 1-2, 38, 40, 50, 102, 109, 112, 144; see Stone
- Lincoln, Abraham, 82
- Lincoln, Robert, 97
- Lincoln Memorial, 141
- Litigation, 90, 110, 113-15, 119, 121, 126, 130, 162, 165; see Claims
- Little, Israel, 85
- Little Kanawha River, WV, 104, 157
- Little Mail*, 62, 66, 73
- Little River, KY, 46
- Livermore, Alonzo, 26, 36, 47, 52, 59, 73
- Livermore, Jairius, 47
- Lock dimensions, 109, 131, 144-45, 151; see Lift
- Lockgates, 34-35, 37-39, 52-53, 64, 66-67, 72, 77-78, 82, 86-88, 96, 107, 111, 113-14, 122, 136-37, 144-45, 148-50, 153, 157
- Lockhouses, 34, 37, 39, 60, 64, 74, 105, 113, 124-25, 128, 133, 136, 144, 148, 150, 155, 162, 167
- Lock keepers, 64, 74, 79, 82-83, 87-90, 113-14; see Lockmasters
- Locks (navigation), 5, 10, 15-18, 25-26, 109, 121-22, 128, 144-45; see numbers of locks and dams
- Locks and dams, 5, 11, 15, 21, 24-26; state project, 15-90; federal project, 91-168.
- Lock and Dam No. 1 (Horseshoe Bend), 34, 37-39, 42-44, 47, 49, 52-53, 56-60, 62-64, 66, 72-75, 77-79, 82, 85-87, 90, 95, 97-98, 112-14, 122, 124, 139, 149, 151, 158, 162-63
- Lock and Dam No. 2, (Six Mile) 34, 37-39, 42-44, 47-52, 55, 58, 60-61, 63-64, 72-75, 82, 85-86, 151, 155
- Lock and Dam No. 3, (Cedar Creek) 10, 37-39, 42-44, 47-52, 55, 58, 60-61, 63-64, 72-75, 80, 84-85, 87-88, 151
- Lock and Dam No. 4, (Lee's Ripple, Frankfort) 34, 37-40, 42-44, 47-52, 55, 58, 60, 63-64, 67, 72-75, 85, 87-88, 92, 94, 97-98, 102, 105, 113, 122, 128, 135, 138, 144-45, 149, 151, 153-54, 158, 162-63; see Frankfort Repair Station
- Lock and Dam No. 5, (Steele's Ripple) 37-40, 42-44, 47, 49, 52-53, 60, 64, 67-68, 69-71, 75, 82, 85, 92, 95-98, 105, 107-08, 113, 144, 151, 153, 157-58, 162-65
- Lock and Dam No. 6, 46, 53, 71-72, 78, 89-90, 103, 105, 108-09, 113, 117, 144, 151, 167
- Lock and Dam No. 7, 46, 53, 71, 89-90, 105-06, 109-13, 116-17, 139, 144-45, 147-48, 150-53, 158, 165
- Lock and Dam No. 8, 46, 53, 71, 105, 111-12, 116-18, 129, 139, 144, 151, 154-55, 157-58
- Lock and Dam No. 9, 71, 113, 119-21, 123-27, 129-130, 139, 144-45, 151
- Lock and Dam No. 10, 71, 119-21, 123-27, 129-130, 144, 146, 151, 156, 167
- Lock and Dam No. 11, 119, 119-20, 127-30, 139, 144-45, 151
- Lock and Dam No. 12, 119-20, 127-30, 139, 144-45, 149-51, 153, 155
- Lock and Dam No. 13, 119, 127, 129-34, 139, 144, 151, 153-55
- Lock and Dam No. 14, 103, 119, 129-37, 139, 141, 144, 151-55, 157-58, 162-63, 165, 167
- Lock and Dam No. 15; see Beattyville Dam
- Lock and Dam No. 37 (Ohio River), 154
- Lock machinery, 38, 123, 128, 144, 157; see Lockgates
- Lockmasters, 64-66, 74, 96, 105, 113-14, 122, 126, 128, 138, 145-50, 154-57, 162, 167; see names of lockmasters
- Lock operations, 38, 64-65, 122, 144-50; see numbers of the locks
- Lockwalls, 38, 44, 48, 53, 56, 68, 96, 102, 106, 111, 123, 135, 144, 147, 149, 154
- Locomotives, 26-27; see Railroads
- Logging, 30, 51, 55, 58, 64, 77, 80, 91-92, 96, 98-102, 110, 115-16, 119, 124-26, 130, 137, 141, 143, 151, 161; see Trees, Timber, Forests
- Logistics, 81, 85-87, 92; see Defense
- Lografts, see Logging
- Long, Stephen H., 20, 22, 30, 35
- Lottery, 10, 18
- Louisville, KY, 2, 11, 13, 18, 23-24, 26-27, 29, 35, 37, 40, 45, 48, 51-54, 56, 62, 66, 70-71, 73-74, 77-78, 80, 82-83, 85, 90, 92, 98, 101-03, 107, 115, 121, 131, 139, 143, 146, 158, 161, 165
- Louisville and Nashville Railroad, 21, 136
- Louisville and Portland Canal, 15, 18, 21, 34, 87
- Louisville Engineer District, 108, 122, 155, 158, 161-63
- Louisville Journal*, 27, 66

- Low water (flow), 2, 5, 10, 14, 19, 29, 31-32, 43, 61-62, 67, 75, 82, 88, 103, 107, 109, 127, 136; see Droughts, Water Supply
- Lucien Johnson* (towboat), 113, 150
- Lumber, 25, 27, 35, 37, 46, 59, 78, 101, 110, 115, 124-26; see Timber, Logging, Sawmills
- Lytle, Randall, 162
- Madison, James, 25
- Madison, IN, 2, 39, 50, 73, 138, 141
- Maintenance, 14, 63-68, 72-73, 76-80, 93-91, 105, 112-13, 129, 132, 144-68
- Maltby, F. B., 135
- Management, 73, 78, 81, 86, 88, 90, 97, 120-21, 125, 135
- Manchester, KY, 36, 45-46
- Maneuver boat, 133, 145
- Maneuvers, 128
- Manifests, 82; see Cargo
- Manufacture, 24-25, 28, 42, 63, 69, 71, 73, 76, 86, 91-92
- Maps, 19, 22
- Marine engineering, 29; see Ships, Flatboats, Steamboats, Towboats
- Marine way, 113, 135, 145, 154
- Markets, 8, 11, 14, 18-19, 21, 26, 31, 37, 45, 60, 73, 91, 99, 115-16; see Commerce
- Marr, John, 155
- Masonry, 22, 25-26, 33-34, 38, 41-42, 44-45, 49-50, 53, 56, 92-94, 102, 105, 108-09, 111-12, 117, 119, 122, 144; see Stone, Locks, Lockwalls
- Mason and Hoge Co., 124
- Massachusetts Institute of Technology, 103, 121
- Matching funds, 20-21, 43
- Matthews and Wilson Company, 39-40, 60
- May, William I., Jr., 168
- Mayo Clinic, 146
- Maysville, KY, 8, 17-18, 20-21, 27, 62, 74
- Maysville Road, see Maysville, KY
- McAlpine, William, 103, 121, 126, 128, 141
- McAlpine Locks and Dam, 103, 121
- McBride, James, 4
- McCarty, Henry, 67
- McCrackin, C. H., 145
- McCreary, James B., 91-93, 101, 104
- McCormick, H. G., 135-36
- McGuire, John, 86
- McKee, Charles, 148
- McKee, William R., 47, 53-54, 62-63, 71
- McLaughlin, Thomas, 47
- McNary, William, 84
- McPheron, R.H., 145
- Melanthy, John, 9
- Memphis, TN, 62
- Mercer County, KY, 89
- Merrill, William E., 93, 97, 108
- Metcalf, Thomas, 15, 20-23, 28, 52, 56, 69, 71-73, 80
- Mexican War, 69, 71-72
- Middle Fork, Kentucky River, 1, 31, 136, 151, 153, 160
- Miles, John, 9
- Milldams; see Mills
- Miller Creek, KY, 11, 87
- Mills, 2, 10-11, 25, 31-32, 45, 50, 59-60, 63, 126, 141; see Sawmills, Furnaces
- Milton, KY, 161
- Minerals, 27, 30, 69-71, 76, 78, 89, 91, 116, 140, 143, 154; see Coal, Salt, Iron
- Mines, 37, 41-42, 45, 70, 88, 92, 99, 138, 140, 152; see Coal, Salt
- Minister, 2, 77
- Minnesota*, 146
- Mississippi River, 8-9, 12, 17, 23, 35, 83, 155
- Missouri River, 12-13
- Miter, 88, 96, 123, 153
- Mobilization, 71, 81-86, 109, 137-38, 153; see Wars
- Modernization, 151, 159-60
- Moeser, Edmund, 121
- Moon, S. H., 47
- Monolith, 132-36
- Monongahela River, 4-5, 12, 25, 45, 67, 78, 88, 100, 104, 123, 137
- Monopoly, 29, 54, 62-63
- Monroe* (launch), 113
- Monroe, James, 16-17, 20
- Monterey*, 72
- Monterey, KY, 85
- Montfort, J., 64
- Morehead, James, 15, 23-28, 30-31, 35-36, 43-44, 46, 48, 50, 52-53, 56
- Morgan, John Hunt, 81

- Mortar, see Cement
- Motorboats, 143, 146
- Mountains, 1, 3, 36, 42, 46, 69-70, 72, 74, 89, 91, 94, 97-98, 115, 126, 132; see Appalachians, Three Forks
- Movable dams, see Crests
- Mud River, KY, 46
- Muhlenberg*, 155
- Muldrow, Andrew, 18-22
- Munday, Jeremiah, 86
- Munday's Landing, KY, 37, 61-62, 140
- Murray, William, 97
- Muskingum River, OH, 46, 104, 121, 145, 157
- Muscle Shoals canal, 18, 30
- Nancy L.*, 137
- Nancy M.*, 155
- Narrows, 36, 46; see South Fork, Kentucky River
- Nashville, TN, 1, 17, 20, 23
- Natcher, William, 165
- Natchez Trace, 8
- National Recreation Area, 161
- Native American Indians, 3-5, 7, 29
- Natural Bridge, 160-61
- Natural resources, 27-28, 34, 71, 76; see Forests, Soils, Minerals, Water
- Natural Resources Cabinet, 164, 166
- Nature Conservancy, 167
- Navigation, early, 1-14; improvement of, 15-28; locks and dams, 29-168; see Canoes, Flatboats, Keelboats, Ships, Steamboats, Towboats, Barges, Slacwater, Locks and dams
- Navigation aids, 10, 64
- Navigation companies, 10, 71, 76
- Needles, 127-28, 139
- Negotiations, 39, 134, 163-64
- Nellie Willet*, 137
- New Argo*, 40, 50-52, 55, 73
- New Orleans*, 12
- New Orleans, LA, 8-11, 13, 17-20, 29, 35, 71, 73, 91, 131, 137
- New York, 18, 20-21, 36, 41
- Newspapers, 26-27, 29, 59, 61, 65-66, 68, 86, 91, 103, 124, 131, 137-38; see names of newspapers
- Nicholas County, KY, 72-73
- Nixon, Richard, 160
- North Fork, Kentucky River, 1, 25, 31, 41, 102, 115, 125, 136, 141, 151, 160
- Nourse, James, 4
- Nunn, Louie, 160
- Oakes, John C., 129
- Obstructions, 4-6, 10-11, 13-14, 18-19, 23, 27-28, 30-32, 36, 45-46, 62, 70, 73, 75, 101, 103, 115; see Ripples, Rocks, Snags, Bridges
- Ocean*, 58, 61, 66
- Ohio, state, 18, 24, 41, 45, 104, 121, 124, 157, 159
- Ohio River, 1-2, 4-5, 8, 12-13, 15, 17-19, 21-25, 34-35, 37, 39, 42, 45-46, 52, 61-61, 67, 71, 74, 78, 83, 86, 88, 97, 99, 102, 104, 107, 116, 120-21, 123, 128, 130-31, 137, 139, 141-42, 145, 151, 154-55, 161, 165
- Ohio River Contracting Co., 129
- Ohio River Division, 120, 149, 154
- Oil, 138-40, 143, 146, 149, 154-55, 162, 166
- Onward*, 139
- Operations, 45, 47, 55, 58; of state locks, 61-90; of federal locks, 91-168; of movable dams, 128; see Locks, Lockmasters
- Oregon, KY, 37, 72-73, 108
- Owsley, William, 21, 36, 39, 50, 53, 71-72
- Pace, Proctor, 134
- Packets, 108, 116, 131, 139, 141; see Steamboats
- Page, Thomas, 77, 80, 82
- Paint Lick Creek, KY, 72
- Paleontology, 1, 49
- Palisades of Kentucky River, 1-2, 5, 114, 137, 143, 146-47, 161, 167-68
- Panama Canal, 102, 111, 121, 135
- Panbowl, 160
- Park City*, 114
- Parks, 92, 114, 167-68; see State parks
- Parrish, Roy, 162
- Passengers, 7, 11, 27, 29, 55, 62, 64-66, 73-74, 79, 87, 108
- Paving, 122, 125, 144
- Pay, see Salary, Labor
- Payroll, 57; see Salary, Labor
- Pearl* (launch), 113
- Penitentiary, 59, 92, 149
- Pennsylvania, 4, 10, 18, 20-21, 25-26, 30, 32, 35-36, 38, 44-45, 58, 100, 104, 123

- Perkins, Carl, 158-61
- Perkins, Richard, 7
- Permits, 8, 82
- Perry County, KY, 25
- Perryville, KY, 83, 86
- Peterkin, W. G., 133-34
- Petersburg, KY, 8
- Petersburg, VA, 94
- Petroleum, 155; see Oil, Gasoline
- Philadelphia, PA, 122
- Pile drivers, 49, 56, 107
- Piling, 19, 49, 56, 75, 96, 100-02, 107, 109, 112
- Pilots, 6, 10, 13, 50-51, 61, 70, 113; see Steamboats, Towboats, names of pilots
- Pineville, KY, 35, 159
- Pink Varble No. 2*, 83
- Pioneers, 1-14, 25, 100, 105, 152
- Pipeline, 140, 143, 158, 165
- Pittsburgh, PA, 4, 13, 18, 26, 36, 41, 45, 48, 62, 88, 98, 116, 137
- Planning, 13-15, 19, 27-28, 47, 108, 151; of state locks and dams, 30-42; see Surveys, Designs
- Pleasant Hill, KY, 110
- Pleasure boats, 114; see Recreation
- Plough Boy*, 29
- Plymouth*, 149
- Poe Lock, 113, 123
- Poe, Orlando M., 108, 112
- Poiree dams, 127-28, 139
- Policy, 23, 31, 43, 48, 53, 73, 90, 120, 131
- Politics, 15-28, 48, 80, 157-68; see Elections, names of political parties
- Pollution, 143, 151-53, 166-67
- Pools, 5, 31, 33, 39, 52, 60, 67, 70, 74, 82, 85, 100, 103, 107, 109, 127, 151
- Population, 23, 35, 42, 68, 89, 101, 116, 152-53
- Pork, 73, 79; see Agriculture
- Porkbarrel, 131, 135-138, 142
- Portage, 3, 6, 36
- Port William, see Carrollton, KY
- Ports, 10, 23, 93; see name of port
- Post, James C., 98-101
- Powell, Lazarus, 77
- Powell River, TN, 35
- Powell, Roger G., 149
- Power, hydroelectric, 150-51; see Mills
- Precipitation, 1-2, 5; see Rain, Ice, Snow, Drought
- Preston, Squire, 126
- Princess*, 140
- Prison, 59, 92, 149; see Crime
- Proctor, John R., 91-92
- Proctor, KY, 69-70, 72, 100
- Profiles, 22; see Fall
- Profits, 59, 67, 69, 76, 78, 101; see Benefits, Investments
- Projects, open channel, 13, 18-20; state locks and dams, 15-90, federal locks and dams, 91-168; see names and types of projects or structures
- Providence*, 13
- Pryse, KY, 140
- Public Enemy No. 1, 160
- Public meetings, 97, 99-100
- Pumps, 38, 53, 56-57, 59, 106, 109, 136, 139, 149
- Purcell, Thomas, 42
- Pushboats, 58, 70, 99, 103, 141
- Quality control, 66, 109, 111, 122-23
- Quarry, 39-40, 50, 53, 102, 109, 111; see Stone
- Quarterboats, 150
- Quoins, 123
- Rafts, 37, 79, 115-16; see Logging
- Rain, 5, 7, 19, 29, 58, 125, 165; see Floods, Droughts
- Railroads, 15, 17-18, 23-24, 26-27, 29, 35-36, 41, 53-54, 62-63, 66, 72-74, 77-78, 80-81, 86, 88, 92, 98-99, 101, 103-04, 107, 114, 116-17, 124, 131-32, 134, 136-38, 141, 143, 153, 159; see names of railroads
- Rand, Lewis, 131-35
- Rapids, 4-6; see Falls, Ripples
- Rauch and Ferguson Company, 39, 610
- Ravenna, KY, 129
- Reagan, Ronald, 163
- Real estate, 21, 24, 60, 76, 89, 94, 110, 119-20, 123, 129, 167
- Recreation, 5, 92, 113, 143-49, 152, 154, 157, 161-68
- Redbird Fork, 11
- Red River, KY, 11, 40, 45
- Red River Dam, 160-61
- Red River Iron Works, 11, 45, 78, 87, 116

- Redstone, PA, 5
- Reductions in force, see Layoffs
- Referendum, 76-77, 93
- Refineries, 139-40, 154
- Refuse, 115, 152; see Regulatory
- Regatta, 91, 161
- Regulations, 64, 113-16, 119, 126, 130, 146
- Regulatory functions, 103, 105, 114-16, 126, 130
- Reinforcement, 123
- Repair depot, 113, 135, 139, 145, 149-50, 154-55
- Repair party, 148-50, 153-55; see Repair Depot
- Reports, 35, 47, 116-17, 151; see Surveys
- Reservations, 113-14, 146-47, 155, 167
- Reservoirs, 144, 151-53, 160-61, 165
- Resident engineers, 36, 38, 47, 55, 66, 107, 124, 134, 135-36
- Resources, 17, 27-28, 30-31, 34-35, 45, 52, 69, 74, 76, 78, 81, 86, 89, 91, 94, 116; see Finances, Minerals, Forests, Coal, Salt, Natural resources, Environment
- Retainage, 59
- Revenues, see Tolls, Taxes
- Rhine River, 143, 146, 156
- Richland Creek, KY, 35
- Richard Roe*, 141
- Richmond Chronicle*, 68
- Richmond, KY, 69-71, 75, 152
- Richmond, VA, 94
- Riffles, 5; see Ripples
- Rifleman*, 12
- Riney-B Railroad, 103
- Ripples, 2, 4-6, 10-11, 13, 19-23, 30-34, 108; see names of ripples
- Riprap, see Rock, Stone
- River, see names of rivers
- River and harbor acts, 99, 105, 114-15
- River banks, see Erosion
- Roads, 5, 15, 17-18, 20-21, 23, 99, 101, 127; see Turnpikes, Highways, Railroads
- Rockcastle River, KY, 31
- Rock, 1-3, 5-6, 10-11, 31, 38, 45-46, 51, 57, 67, 77, 103, 125, 129; see Stone
- Rock Island, IL, 59
- Rodolph*, 29-30
- Rogers, Hal, 167
- Romans, 49
- Rope, 4, 6, 9, 11, 107
- Roper, Willard, 161
- Rough River, KY, 122
- Royal*, 137
- Ruffner, Ernest H., 120-26
- Runoff, 2; see also Precipitation, Floods
- Russell, John W., 30
- Russellville, KY, 47
- R. W. Turner*, 154
- Sabotage, 80-81, 85-86, 155
- Safety, 114, 145, 149, 154; see Hazards, Accidents
- Sailing ships, 4, 9-10, 14
- Saint Clair Street Bridge, 114-15
- Saint Louis, MO, 13, 17, 29, 62, 75, 85
- Salary, 36, 41, 47-48, 52, 55, 60, 64-65, 72-73, 78, 82, 84, 87-90, 97-98
- Salt, 3, 11, 13, 30-31, 35-36, 41, 45, 46, 64, 70, 74, 76, 78, 87, 94, 116, 166
- Saltboats, see Salt
- Saltworks, see Salt, Goose Creek
- Salt River, KY, 28
- Salvisa, KY, 126
- Sample, John, 138
- Sampson* (dredge), 87-88
- Samuels, C. J., 29
- Sand and gravel, 31, 137, 154, 158, 162; see Bars
- Sanders, Samuel, 83, 85
- Sault Ste. Marie, MI, 108, 113
- Savannah River, 18, 31, 35
- Sawlogs, 115-16, 119, 124-26, 152; see Logging, Sawmills
- Sawmills, 59, 63, 70, 109, 115, 119, 125-26, 141, 152
- Saylor Park, 154-55
- Scenery, 5, 146-47, 152, 161; see Environment, Palisades
- Schedules, 37, 42, 46, 55, 63-65, 74, 96, 129-37
- Schools, 42-43
- Science, 29-42, 47, 51
- Scott, Addison, 121
- Scott, A. R., 63
- Scott, Charles, 8
- Scotts Landing, 8-9

Scour, see Erosion

Sea Gull, 71, 73

Sea Lion, 126, 140

Secretary of State, 91-92

Secretary of War, 16, 20, 43, 97, 147

Sediment, 5, 10, 34-35, 38, 45, 52; see Bars, Erosion

Seepage, 107; see Leaks, Breach

Settlement, 59-60, 74, 107, 112

Sewage, 152, 166-67

Shakers, 110

Shakers Ferry, KY, 61, 78, 83, 147

Shakertown, KY, 165

Shaler, Nathaniel S., 91-94, 98, 103

Shamrock, 159

Shearer, Oliver F., 140, 149

Sheetpiling, 75, 102, 107

Shelbyville, KY, 151

Sheridan, Thomas A., 111-12

Sheridan-Kirk Co., 123-24

Sherman, William T., 85

Shanks, Thomas, 121

Ships, 2, 9, 14

Shoals, see Ripples

Shops, 13

Showboats, 140

Shyrock Ferry, 19, 79

Sibert, William L., 102

Sills, 88, 96, 123; see Miter

Simpson, James H., 83

Simpson, William, 145

Sinking fund, 42-43, 52-53, 55, 89-90

Sites, 34, 37, 40-41, 99, 108, 123, 127, 144; see Real Estate, Foundations

Six Mile Creek, KY, 34, 39, 79; see Lock and Dam No. 2

Six Mile Island, Ohio River, 52

Skelton, Matthew, 47

Skiles, James R., 23, 26, 36, 42

Slackwater, 14-15, 21, 24-26, 29-42, 105, 116-17, 123; see Locks and dams, Pools

Slackwater (dredge), 74, 77

Slaughter, Gabriel, 13

Sluice, 38, 88

Smith, Clement, 89

Smith, J. Speed, 52, 69-70, 75, 77, 80

Smith, Towles and Company, 132

Snagboats, 109, 112-14, 124; see names of boats

Snags, 3, 6, 10-11, 13, 31, 39, 45, 72, 101, 112, 136, 154

Snow, 1, 155

Snyder, Antes, 26, 36, 58

Soils, 3, 24, 32, 57

Sonoma, 114

Sophia, 9

Soundings, 31, 94, 96

South Fork, Kentucky River, 1, 11, 13, 31, 35-36, 41, 45-46, 53, 87, 115, 136, 141, 150-51, 153

Sparks, John, 162

Specifications, 37-38, 47, 94, 111, 124-25; see Contracts, Bids, Inspection

Spence, Mark, 147-49

Splash dams, 98

Sprigg, Robert, 9

Springport, KY, 86

Springs, 2-3, 5

Stagecoach, 49, 62

State capital, see Frankfort, KY

State engineers, 30-36, 47, 52-53, 56-59, 66; see Civil engineers, names of engineers

State of Kentucky, internal improvements, 15-28; locks and dams projects, 29-90; see Legislature, Governors, Commonwealth

State parks, 161, 166-68

States rights, 16, 20-21

Station Camp Creek, KY, 3-4

Stealey, George, 36, 38, 40, 45, 47, 57, 59, 76, 85-86

Stealey, Matthew, 26, 30, 36-38, 40, 44, 47-60, 66, 71

Steamboats, 2, 12-14, 26-27, 29-30, 34-35, 37, 43, 45, 49-53, 55, 61-62(schedule), 68-69-73, 79, 83, 85, 91, 96, 103-04, 108, 114, 116, 120, 126, 131, 136-37, 139, 141, 168; see names of steamboats

Steam electric plants, 151, 159, 161

Steam engine, 57, 59, 63, 69, 74, 110; see Steamboats, Locomotives

Steel, 103, 119, 123, 127-29, 132, 136, 144-45, 153, 159

Steele Island, 10

Steele, Samuel, 50-51, 62-63, 73-75, 78, 80, 84, 87-88

Steele's Ripple, 37, 39; see Lock and Dam No. 5

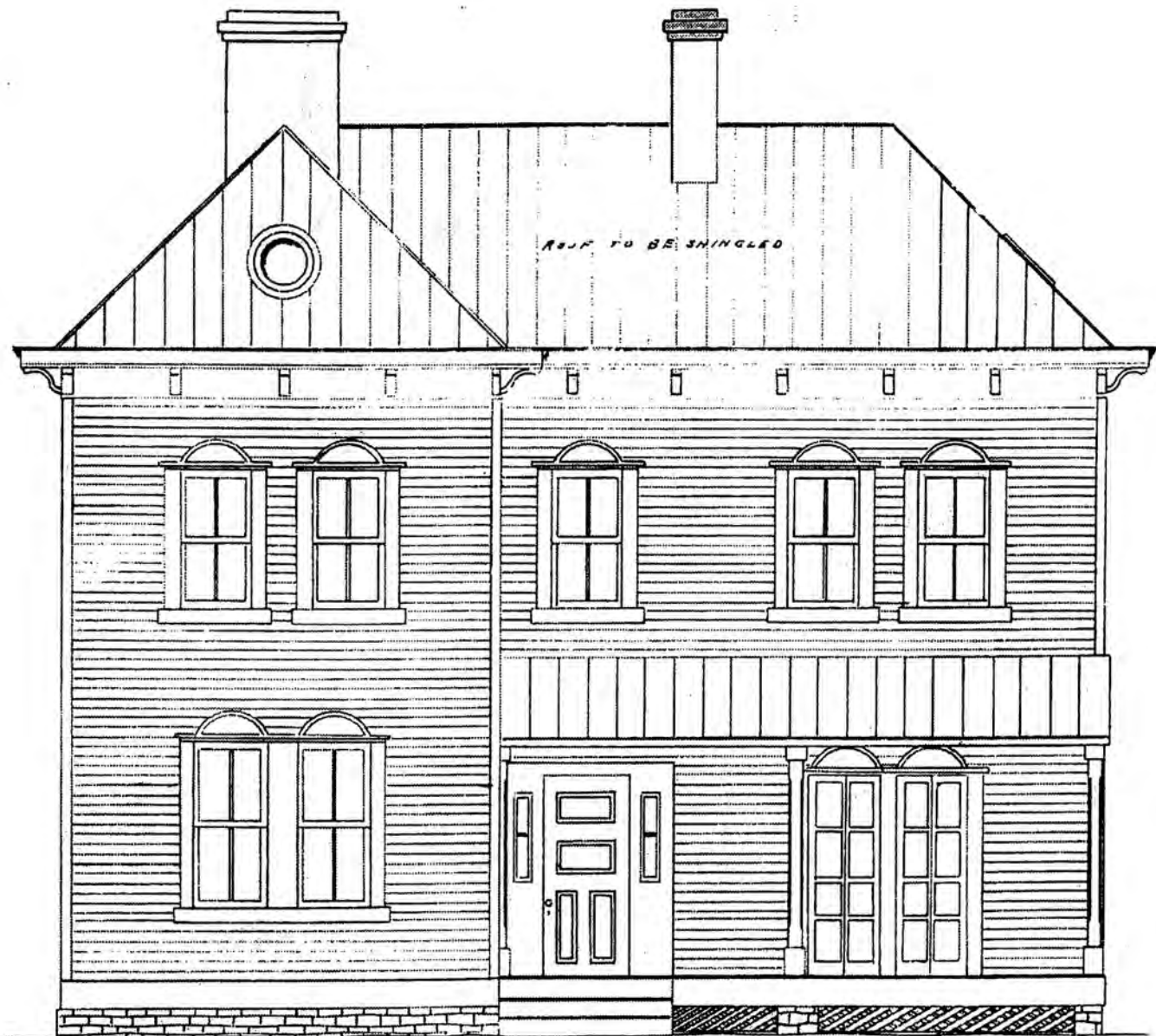
- Stevenson, John, 89
- Stewart, D. D., 159
- Stickney, Amos, 108
- Stocks, 2, 10, 46-47, 53-54, 71, 86, 99; see Bonds, Investments, Capital
- Stone, 20-21, 23, 25-26, 33, 39-41, 43, 45, 49-50, 58, 71, 73, 75, 85, 88, 101, 110-11, 129, 144; see Quarry, Masonry
- Stonehammer, see Metcalfe, Thomas
- Stony Creek, KY, 39
- Strader, D. W., 74
- Stuart, John, 6
- Sublett, David L., 98, 105, 108
- Sugar Creek, KY, 17
- Suicide, 97
- Summer Girl*, 147
- Superintendents, 47-49, 66, 73, 83-84, 88, 97, 134-35, 145, 150
- Surveys, 5, 13, 17-23, 26-27, 47, 99, 109, 141, 150-52; by Baker, 30-37; by Welch, 36-38, 71; by Fitzhugh, 92-96; at Beattyville, 99; multipurpose, 151
- Susquehanna River, PA, 26, 100
- Swigert, Philip, 29, 40, 50, 54, 62-63, 66-67, 71, 82-83, 86-88
- Swim, 91, 114, 147; see Recreation
- Taxes, 16, 18, 50, 52-55, 65, 72, 75, 86, 93
- Taylor, Charles, 53
- T. D. Dale*, 108
- Teays River, 2
- Technology, 105, 119, 122, 129-30
- Tedious Creek, KY, 46
- Tennessee, 8, 30-31, 36, 84
- Tennessee River, 18, 30-31, 35, 104, 111, 121
- Terminals, 70, 99, 154-55; see Landings, Wharf
- Tests, 40, 96; see Experiments
- Texaco Company, 140
- Thirteen, KY, 132, 134
- Three Forks, 1, 10, 30-31, 37, 40-41, 45, 61, 68-69, 70-72, 74-78, 88-91, 94, 98-99, 105, 115-16, 119, 123, 127, 129-137, 141, 145, 152-53, 166-67; see name of fork, Beattyville, KY
- Three Forks Investment Company, 101
- Thomas, Benjamin, 121, 127-28, 138
- Thomas, Estill, 162
- Thompson, Addison, 89
- Thompson, Joseph, 77
- Thomson, Manilus, 42
- Tides, 2, 6, 11, 14, 31, 70, 72, 92, 98, 115; see Floods
- Tilford, John, 43
- Timber, 25, 30, 39, 49, 74, 76-78, 89-91, 94-95, 98-99, 105, 109, 115-16, 126-27, 141, 152-53; see Forests, Trees, Lumber, Logging
- Timbercribs, 25-26, 33-34, 38, 45, 51, 55-58, 67, 69, 72-73, 75, 85, 87, 90, 92-98, 103, 105-19, 122, 124, 129, 150, 153
- Tobacco, 8-9, 13, 19, 76, 79, 94, 104, 108, 137, 146
- Todd, Harry, 62, 68-70, 86
- Todd, John, 82
- Tolls, 10, 18, 21, 45, 47, 59, 61, 64-65, 67-74, 76-85, 87, 89-90, 96, 104
- Tombigbee River, 18
- Tomlinson, George, 158
- Tom Metcalfe*, 62-63, 66
- Tonnage, 35, 45, 65, 74, 88, 116, 145, 154; see Cargo, Commerce
- Tools, 49, 56-58, 65, 67, 74, 78, 105-06, 110, 122
- Topography, 1, 22
- Tourists, 143-44, 152; see Recreation
- Towboats, 2, 4, 6, 37, 45, 62, 88, 108, 116, 119, 123, 126, 137-38, 140, 154, 159
- Trade, see Commerce
- Tradewater River, KY, 46, 93
- Traffic, 10-11, 131, 136, 143, 145
- Tramway, 11, 26, 70, 111, 113
- Transfer, 158, 163-68
- Transit*, 61
- Transportation, 1, 15, 19, 20-21, 26, 120, 141; see mode of, Internal Improvement, Commerce
- Transportation projects, see Turnpikes, Railroads, Locks and Dams
- Transylvania University, 72
- Travel, 88-89; see mode of travel
- Treasury, 55-56, 59, 65, 67, 69, 73, 78, 80-81, 88, 93
- Trees, 3-4, 10, 27, 49, 51, 78, 96, 113; see Forests, Logging, Lumber
- Trestles, 127-29, 132-33
- Tributary, 1-3, 5, 34, 46, 83, 120-21; see names of tributaries
- Trimble County, KY, 86
- Trucks, 141, 151; see Highways

- Truman, Harry, 158
- Tunnel, 35-36
- Turnbull, William, 17, 22-23, 30-31
- Turner, Thomas, 93
- Turnpikes, 15, 17-18, 21, 23, 27, 30, 35-36, 41, 47-48, 52-53, 65, 68, 70, 80-82, 84; see Roads
- Twine, 92
- Tyrone, KY, 9, 20, 159, 161
- Underwood, Joseph, 62
- Underwood, Thomas, 158
- Union army, see U. S. Army
- United Society of Believers, 110
- United States* (steamboat), 90
- Upper Howard Creek, 3
- Urban renewal, 160
- U. S. Army, 81-87
- U. S. Army Corps of Engineers, build steamboat, 13; survey rivers, 17-23; repair state locks and dams, 91-98; build Beattyville dam, 99-104; build locks and dams 6 to 8, 105-18; build locks and dams 9 to 12; build locks and dams 13 and 14, 131-42; operate locks and dams, 143-56; manage Kentucky River water resources, 157-68; see Locks and Dams, Flood control
- U. S. Attorney, 110, 126, 134, 148-49
- U. S. Coast Guard, 158
- U. S. Comptroller General, 162
- U. S. Geological Survey, 166
- U. S. Military Academy, 30, 42, 47, 94, 121
- U. S. Public Health Service, 152
- Vandalism, 146; see Crime
- Valley, 1-2, 35
- Valley Belle*, 140
- Valley View, 7, 61, 120, 123
- Value, 51, 60, 89-91, 98; see Benefits, Costs, Investments
- Valves, 34, 38, 67, 100-01, 123, 157, 166
- Versailles, KY, 48, 152
- Veto, 17, 21, 23-24
- Vevay, IN, 86
- Village, 3, 86; see name of village
- Vim*, 141
- Virginia, 4, 10, 17-18, 25, 86
- Wabash River, 46, 104, 112
- Wages, 57; see Labor, Salary
- Wagons, 65, 70, 85, 99, 101; see Horses
- Walker, Thomas, 4
- Walters, John, 156
- Walthers, Charles, 121
- Wapping Street, 9
- Ward* (dredge), 112
- Ward and Moffett, 29
- Warehouses, 9-10, 13, 29, 67, 74, 113, 122
- War, 16, 81-86, 102, 111, 125, 131-38; Secretary of, 16, 20, 43, 97; see Defense, names of wars
- War, Mexican, 69, 71-72
- War of 1812, 9, 11-13, 15, 20
- Warren, James G., 126
- Warrior's Path, 3
- Warren County, KY, 23
- Warwick, KY, 9, 37
- Washington, DC, 43, 111, 141
- Washington, J. T., 62
- Wastes, 152
- Watercraft, 2, 10; see type of boat
- Water power, 10, 25, 27, 32, 42, 45, 50, 63, 75, 91-92, 105, 150-52; see Mills, Hydroelectric
- Water resources, 120, 131, 157, 165; see Navigation, Flood Control, Hydroelectric, Recreation
- Water quality, 143-44, 151-53, 156-57, 162-68
- Water supply, 1-3, 143, 151-52, 157-58, 162-68
- Waterways, see names of waterways
- Watson, E. H., 60
- Watson, John, 83, 89
- Watt, John M. G., 110-11
- Watts, John C., 158
- Watts, Thomas, 9
- W. B. Cole*, 108
- Wealth, 15, 27, 42-43, 51, 74, 76, 78, 92; see Economics, Finances
- Welch, Sylvester, 26, 32, 36-43, 45-49, 53, 56-60, 66-67, 70-72
- Wells, Houston, 168
- Wernwag bridge, 37
- Wessels, Robert, 161
- West, Edward, 12
- Westerfield, John, 121
- Western Engineer*, 13

Western Military Institute, 72, 91
 West Liberty, KY, 41
 West Point, see U. S. Military Academy
 West Virginia, 87, 98, 111, 120-21, 123-24, 127, 132
 Weston, William, 25
 Wetherby, Lawrence, 158
 W. F. Garretson Company, 132-33
 Wharf, 13, 64, 137
 Wheeling, WV, 4
 Whig party, 15, 21, 23-24, 28, 48, 71, 77, 80, 84, 91, 167
 Whiskey, 19, 64, 77, 83, 108, 114, 152, 159
 White, Canvass, 36
 White, Dougherty, 45
 White elephant, 143, 154
 White, James, 11, 31
 White, John D., 97, 99
 White, Josiah, 34, 36
 Whitesburg, KY, 141
 Wickets, 99-100, 127-28
 Wickliffe, Charles, 46, 48, 50
 Wickliffe, Robert, 20
 Wilderness Road, 5
 Wilkinson, James, 8
 Wilkinson, Wallace, 165

Williams, John, 94
 Williams, Sydney, 46
 Willie (dredge), 112
 Willie B., 137
 Wilson Knott and Co., 60
 Wilson, Woodrow, 131, 141
 Wm. R. McKee, 62
 Winchester, 9
 Winchester, KY, 21, 134, 152, 159
 Wingdams, 18-20, 22-23, 26, 30, 45
 Withrow, John, 145
 Women, 60; see names of women
 Wood, Archibald, 42
 Woodford County, 19, 30, 68, 86
 World War, First, 131-37, 141, 143; Second, 143, 154-55, 157
 Worthville, KY, 114, 153
 Wrecks, 10, 55, 114, 139-40
 Wren, 83, 85
 Wright, Horatio G., 99
 Yale University, 91-92
 Yeatman's boatyard, 9
 Yeoman, 91-93, 103
 Young, J. C., 60
 Youghiogheny River, 4

Kentucky River



FRONT ELEVATION



PLAN
FOR
LOCKKEEPERS DWELLINGS
AT
LOCK NO. 6, KENTUCKY RIVER
SCALE $\frac{1}{4}$ " = 1 ft

Made under direction of Lieut. H. E. Waterman
Corps of Engineers U.S.A.

DRAWN BY

G. F. Pickney
Asst. Engr.

FRANKFORT, KY. Oct. 18th 1893

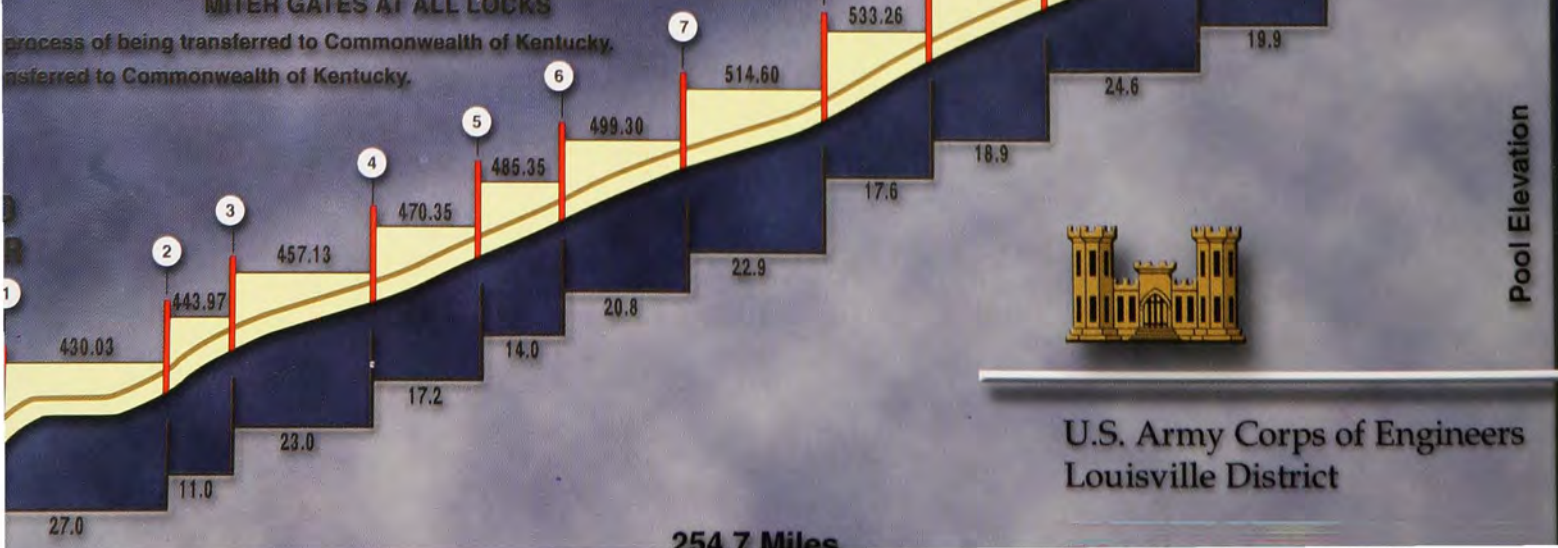
KENTUCKY RIVER BASIN



LOCK & DAM NO.	MILES ABOVE MOUTH.	LOCK		TYPE OF DAM	POOL ELEVATION	
		WIDTH	LENGTH		UPPER	LOWER
1	4.0	38	145	FIXED	430.03	421.80
2	31.0	38	145	FIXED	443.97	430.03
3	42.0	38	145	FIXED	457.13	443.97
4	65.0	38	145	FIXED	470.35	457.13
*5	82.2	38	145	FIXED	485.35	470.35
*6	96.2	52	147	FIXED	499.30	485.35
*7	117.0	52	147	FIXED	514.60	499.30
*8	139.9	52	146	FIXED	533.26	514.60
*9	157.5	52	148	FIXED	550.60	533.26
**10	176.4	52	148	FIXED	567.60	550.60
*11	201.0	52	148	FIXED	585.60	567.60
*12	220.9	52	148	FIXED	602.60	585.60
*13	239.9	52	148	FIXED	620.60	602.60
*14	249.0	52	148	FIXED	637.60	620.60

MITER GATES AT ALL LOCKS

process of being transferred to Commonwealth of Kentucky.
transferred to Commonwealth of Kentucky.



U.S. Army Corps of Engineers
Louisville District